



Hazard Ranking System Documentation Record

**Patrick Bayou Site
Deer Park, Harris County, Texas
TX0000605329**

Volume I of II



REGION VI

**Prepared in cooperation with the
U.S. Environmental Protection Agency**

January 2001

Hazard Ranking System Documentation Record

**Patrick Bayou Site
Deer Park, Harris County, Texas
TX0000605329**

Prepared in cooperation with the

**U.S. Environmental Protection Agency
Region VI**

Prepared by



*Protecting Texas
by Reducing and Preventing Pollution*

**Texas Natural Resource Conservation Commission
Site Assessment and Management Section
Superfund Site Discovery and Assessment Program
Austin, Texas**

January 2001

The preparation of this report was financed through grants from the U.S. Environmental Protection Agency.

TABLE OF CONTENTS

	<u>Page</u>
Reference Listing	10
HRS Documentation Record Review Cover Sheet	1
Notes to the Reader	2
HRS Documentation Record	3
Worksheet for Computing HRS Site Score	6
Surface Water Overland/Flood Migration Component Scoresheet	7
 2.2 SOURCE CHARACTERIZATION	 13
2.2.1 <u>Source Identification</u>	13
2.2.2 <u>Hazardous Substances Associated with a Source</u>	17
2.2.3 <u>Hazardous Substances Available to a Pathway</u>	20
2.3 LIKELIHOOD OF RELEASE	21
2.4 WASTE CHARACTERIZATION	21
2.4.1 <u>Selection of Substance Potentially Posing Greatest Hazard</u>	21
2.4.2 <u>Hazardous Waste Quantity</u>	21
2.4.2.1 <u>Source Hazardous Waste Quantity</u>	21
2.4.2.1.1 <u>Hazardous Constituent Quantity (Tier A)</u>	21
2.4.2.1.2 <u>Hazardous Waste Stream Quantity (Tier B)</u>	21
2.4.2.1.3 <u>Volume (Tier C)</u>	21
2.4.2.1.4 <u>Area (Tier D)</u>	21
2.4.2.1.5 <u>Hazardous Waste Quantity Value</u>	22
Sources Not Evaluated	24
 3.0 GROUND WATER MIGRATION PATHWAY	 25
3.0.1 <u>General Considerations</u>	25
 4.0 SURFACE WATER MIGRATION PATHWAY	 26
4.1 OVERLAND/FLOOD MIGRATION COMPONENT	26
4.1.1 <u>General Considerations</u>	26
4.1.1.1 <u>Definition of Hazardous Substance Migration Path for</u> <u>Overland/Flood Migration Component</u>	28
Overland Segment, Probable Point of Entries (PPEs), Number of Watersheds	28
4.1.1.2 <u>Target Distance Limit</u>	28
4.1.1.3 <u>Evaluation of Overland/Flood Migration Component</u>	29
4.1.2 <u>Drinking Water Threat</u>	30
4.1.2.1 <u>Drinking Water Threat - Likelihood of Release</u>	30
4.1.2.1.1 <u>Observed Release</u>	30
Chemical Analysis	30
Background Concentrations	30
Contaminated Samples	35

TABLE OF CONTENTS (continued)

		Hazardous Substances Released	81
		Attribution	81
		Attribution to Potential Sources	82
4.1.3		<u>Human Food Chain Threat</u>	83
4.1.3.1		<u>Human Food Chain Threat - Likelihood of Release</u>	83
4.1.3.2		<u>Human Food Chain Threat - Waste Characteristics</u>	83
4.1.3.2.1		<u>Toxicity/Persistence/Bioaccumulation</u>	83
4.1.3.2.2		<u>Hazardous Waste Quantity</u>	85
4.1.3.2.3		<u>Waste Characteristics Factor Category Value</u>	86
4.1.3.3		<u>Human Food Chain Threat - Targets</u>	87
4.1.3.3.1		<u>Food Chain Individual</u>	87
4.1.3.3.2		<u>Population</u>	88
4.1.3.3.3		<u>Calculation of HFC Threat - Targets Factor Category Value</u>	88
4.1.3.4		<u>Calculation of Human Food Chain Threat Score</u>	88
4.1.4		<u>Environmental Threat</u>	89
4.1.4.1		<u>Environmental Threat - Likelihood of Release</u>	89
4.1.4.2		<u>Environmental Threat - Waste Characteristics</u>	89
4.1.4.2.1		<u>Ecosystem Toxicity/Persistence/Bioaccumulation</u>	89
4.1.4.2.2		<u>Hazardous Waste Quantity</u>	91
4.1.4.2.3		<u>Waste Characteristics Factor Category Value</u>	92
4.1.4.3		<u>Environmental Threat - Targets</u>	93
4.1.4.3.1		<u>Sensitive Environments</u>	93
4.1.4.3.1.1		<u>Level I Concentrations</u>	93
4.1.4.3.1.2		<u>Level II Concentrations</u>	94
		Wetlands Frontage	95
4.1.4.3.1.3		<u>Potential Contamination</u>	96
4.1.4.3.1.4		<u>Calculation of Environmental Threat - Targets Factor Category Value</u>	97
4.1.4.4		<u>Calculation of Environmental Threat Score for a Watershed</u>	97
4.1.5		<u>Calculation of Overland/Flood Migration Score for a Watershed</u>	98
4.1.6		<u>Calculation of Overland/Flood Migration Component Score</u>	98
4.2		GROUND WATER TO SURFACE WATER MIGRATION COMPONENT	99
4.3		CALCULATION OF SURFACE WATER MIGRATION PATHWAY SCORE	99
5.0		SOIL EXPOSURE PATHWAY	100
5.0.1		<u>General Considerations</u>	100
6.0		AIR MIGRATION PATHWAY	101
6.1.1		Observed Release	101

TABLE OF CONTENTS (continued)

TABLES

	<u>Page</u>
1 Source Description - Contaminated Sediment Samples	17
2 Source No. 1 - Other (Contaminated Sediments) Hazardous Waste Quantity	22
3 Site Summary of Source Descriptions	23
4 Background Samples Collected	31
5 Summary of Highest Inorganic and Organic Background Concentrations	32
6 Contaminated Sediment Samples	35
7 Data Usability for Sediment Samples	76
8 Hazardous Substance Toxicity, Persistence and Bioaccumulation Potential	83
9 Hazardous Waste Quantity - Food Chain	85
10 Hazardous Substance Ecosystem Toxicity, Persistence and Bioaccumulation	89
11 Hazardous Waste Quantity - Environmental	91
12 Environmental Threat - Targets - Level II Concentrations	94

FIGURES

Figure 1a	Regional Location Map	4
Figure 1b	Site Location and Surrounding Land Use Map	5
Figure 2	Site Features Map	14
Figure 3	Sediment Sample Locations	15
Figure 4	Surface Water Pathway	27

**HRS DOCUMENTATION RECORD
REVIEW COVER SHEET**

SITE NAME: PATRICK BAYOU SITE

CONTACT PERSON:

Brenda Cook, USEPA
Region 6 NPL Coordinator

214/665-7436

Pathway, Components, or Threats Not Evaluated

Ground Water Migration Pathway

The Ground Water Pathway was not evaluated due to the lack of targets and because the inclusion of this pathway would not significantly affect the site score.

Surface Water Pathway

The drinking water threat was not evaluated due to lack of targets and because the inclusion of this threat would not significantly effect the site score.

Soil Exposure Pathway

The Resident Population Threat, and Nearby Population Threat, were not evaluated due to the lack of targets and because the inclusion of this pathway would not significantly affect the site score.

Air Migration Pathway

The Air Migration Pathway was not evaluated due to the lack of targets and because the inclusion of this pathway would not significantly affect the site score.

NOTES TO THE READER

The following rules were used when citing references in the HRS Documentation Record:

1. All references attached to this report have been stamped with a designated page number (example: Ref. 1, p. 10 = 001 00010). However, if the reference being cited has an original page number, that page number was cited. If the reference being cited has no original page number or the pagination is not complete, then the designated page number is cited.
2. The State predecessor agencies: Texas Water Quality Board (TWQB), Texas Department of Water Resources (TDWR), Texas Water Commission (TWC), and Texas Air Control Board (TACB), referred to throughout this report are now known as the Texas Natural Resource Conservation Commission (TNRCC). The new agency, TNRCC, became effective September 1, 1993, as mandated under State Senate Bill 2 of the 73rd Regular Legislative Session.

HRS DOCUMENTATION RECORD

Name of Site: Patrick Bayou Site **Date Prepared:** 11/00

CERCLIS Site ID Number: TX0000605329

Site Specific Identifier: Other (Contaminated Sediments).

Street Address of Site: None (see General Location below)

City, County, State: Deer Park, Harris County, Texas

General Location in the State:

The Patrick Bayou site is located approximately 1 mile north of Deer Park, Texas, originating south of SH 225 draining 2.85 miles north to the Houston Ship Channel along the southern Gulf Coast of Texas (see Figure 1a, Regional Location Map and Figure 1b, Site Location and Surrounding Land Use Map)

Topographic Map: US Geological Survey 7.5 Minute Topographic Map, La Porte Quadrangle.

Latitude: 29° 43' 55" North **Longitude:** 95° 06' 52.5" West
(Approximate center of bayou, see Reference 6, Topographic Map)

EPA Region 6

Pathway Scores:

Ground Water Migration Pathway - NE
Surface Water Migration Pathway - 100
Soil Exposure Pathway - NE
Air Migration Pathway - NE
NE = Not Evaluated

HRS SITE SCORE: 50

Figure 1a

Regional Location Map Patrick Bayou Site

A copy of the site location map is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

Figure 1b

Site Location and Surrounding Land Use Map Patrick Bayou Site

A copy of the site location map is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

WORKSHEET FOR COMPUTING HRS SITE SCORE

	<u>S</u>	<u>S²</u>
1. Ground Water Migration Pathway Score (S_{gw}) (from Table 3-1, line 13)	<u>NE</u>	
2a. Surface Water Overland/Flood Migration Component (from Table 4-1, line 30)	<u>100</u>	<u>10,000</u>
2b. Ground Water to Surface Water Migration Component (from Table 4-25, line 28)	<u>NE</u>	
2c. Surface Water Migration Pathway Score (S_{sw}) Enter the larger of lines 2a and 2b as the pathway score.	<u>100</u>	<u>10,000</u>
3. Soil Exposure Pathway Score (S_s) (from Table 5-1, line 22)	<u>NE</u>	
4. Air Migration Pathway Score (S_a) (from Table 6-1, line 12)	<u>NE</u>	
5. Total of $S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2$		<u>10,000</u>
6. HRS Site Score Divide the value on line 5 by 4 and take the square root. <u>50</u>		

NE = Not Evaluated

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET

<u>Factor Categories and Factors</u>		<u>Maximum Value</u>	<u>Value Assigned</u>
DRINKING WATER THREAT			
<u>Drinking Water Threat Score</u>			
1.	Observed Release	550	<u>NS</u>
2.	Potential to Release by Overland Flow:		
2a.	Containment	10	<u>NS</u>
2b.	Runoff	25	<u>NS</u>
2c.	Distance to Surface Water	25	<u>NS</u>
2d.	Potential to Release by Overland Flow		
	[Lines 2a x (2b + 2c)]	500	<u>NS</u>
3.	Potential to Release by Flood:		
3a.	Containment (Flood)	10	<u>NS</u>
3b.	Flood Frequency	50	<u>NS</u>
3c.	Potential to Release by Flood (Lines 3a x 3b)	500	<u>NS</u>
4.	Potential to Release		
	(Lines 2d + 3c, subject to a maximum of 500)	500	<u>NS</u>
5.	Likelihood to Release (Higher of Lines 1 and 4)	550	<u>NS</u>
<u>Waste Characteristics</u>			
6.	Toxicity/Persistence	*	<u>NS</u>
7.	Hazardous Waste Quantity	*	<u>NS</u>
8.	Waste Characteristics	100	<u>NS</u>
<u>Targets</u>			
9.	Nearest Intake	50	<u>NS</u>
10.	Population:		
10a.	Level I Concentrations	**	<u>NS</u>
10b.	Level II Concentrations	**	<u>NS</u>
10c.	Potential Contamination	**	<u>NS</u>
10d.	Population (Lines 10a + 10b + 10c)	**	<u>NS</u>
11.	Resources	5	<u>NS</u>
12.	Targets (Lines 9 + 10d + 11)	**	<u>NS</u>

NS = Not Scored

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET

DRINKING WATER THREAT (Concluded)

<u>Factor Categories and Factors</u>	<u>Maximum Value</u>	<u>Value Assigned</u>
--------------------------------------	----------------------	-----------------------

Drinking Water Threat Score

13. Drinking Water Threat Score [(Lines 5 x 8 x 12)/82,500, subject to a maximum of 100]	100	<u>NS</u>
---	-----	-----------

HUMAN FOOD CHAIN THREAT

Likelihood of Release

14. Likelihood of Release (Same value as Line 5)	550	<u>550</u>
--	-----	------------

Waste Characteristics

15. Toxicity/Persistence/Bioaccumulation	*	<u>5x10⁸</u>
16. Hazardous Waste Quantity	*	<u>100</u>
17. Waste Characteristics	1,000	<u>320</u>

Targets

18. Food Chain Individual	50	<u>20</u>
19. Population:		
19a. Level I Concentrations	**	<u>0</u>
19b. Level II Concentrations	**	<u>0</u>
19c. Potential Human Food Chain Contamination	**	<u>NS</u>
19d. Population (Lines 19a + 19b + 19c)	**	<u>0</u>
20. Targets		
(Value from Lines 18 + 19d)	**	<u>20</u>

Human Food Chain Threat Score

21. Human Food Chain Threat Score [(Lines 14 x 17 x 20)/82,500, subject to a maximum of 100]	100	<u>42.67</u>
---	-----	--------------

NS = Not Scored

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET

<u>Factor Categories and Factors</u>	<u>Maximum Value</u>	<u>Value Assigned</u>
ENVIRONMENTAL THREAT		
<u>Likelihood of Release</u>		
22. Likelihood of Release (Same Value as Line 5)	550	<u>550</u>
<u>Waste Characteristics</u>		
23. Ecosystem Toxicity/Persistence/ Bioaccumulation	*	<u>5x10⁸</u>
24. Hazardous Waste Quantity	*	<u>100</u>
25. Waste Characteristics	1,000	<u>320</u>
<u>Targets</u>		
26. Sensitive Environments:		
26a. Level I Concentrations	**	<u>0</u>
26b. Level II Concentrations	**	<u>50</u>
26c. Potential Contamination	**	<u>NS</u>
26d. Sensitive Environments (Lines 26a + 26b + 26c)	**	<u>50</u>
27. Targets (Value from Line 26d)	**	<u>50</u>
<u>Environmental Threat Score</u>		
28. Environmental Threat Score [(Lines 22 x 25 x 27)/82,500, subject to a maximum of 60]	60	<u>60</u>
SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE FOR A WATERSHED		
29. WATERSHED SCORE*** (Lines 13 + 21 + 28, subject to a maximum of 100)	100	<u>100</u>
SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE		
30. Component Score (S _{ot})*** (Highest score from Line 29 for all watersheds evaluated, subject to a maximum of 100)	100	<u>100</u>

NS = Not Scored

REFERENCE LISTING

Reference Number	<u>Description of the Reference</u>
1.	U.S. Environmental Protection Agency, Federal Register-40 CFR Part 300, <i>Hazard Ranking System</i> ; Final Rule, Volume 55, No. 241, December 14, 1990. 135 pages.
2.	U.S. Environmental Protection Agency, <i>Superfund Chemical Data Matrix (SCDM)</i> . June 1996.
3.	U.S. Environmental Protection Agency, <i>Hazard Ranking System Guidance Manual</i> , Office of Solid Waste and Emergency Response, Publication 9345.1-07, November, 1992. 431 pages
4.	Broach, Linda, Field Operations Division, Region 12, Houston, Texas Natural Resource Conservation Commission and Crocker, Phillip, Water Quality Protection, Region 6, Dallas, United States Environmental Protection Agency. <u>Containment Assessment of Patrick Bayou</u> . December 1996. 70 pages.
5.	Texas Natural Resource Conservation Commission, <u>The State of Texas Water Quality Inventory, Surface Water Quality Monitoring Program, 13th Edition, 1996</u> , Volume 2 - Basin Summaries, Basin Maps, Graphical Basin Summaries, Segment Fact Sheets, and Water Quality Status Tables (Basins 1-10), SFR-50. December 1996. 7 pages.
6.	U. S. Geological Survey, La Porte Quadrangle, Texas, 7.5 Minute Series. <u>Topographic Map</u> . Provisional Edition 1965. (Site location, 1-mile radius, legend and map notations added by TNRCC). 1 page. (Figure 1b).
7.	U.S. Environmental Protection Agency, <i>Preliminary Assessment/Screening Site Inspection Work Plan for Patrick Bayou Site</i> . TX0 000 605 329, Deer Park, Harris County, Texas. March 2000. 188 pages/w attachments.
8.	Texas Natural Resource Conservation Commission. <i>Quality Assurance Project Plan for Texas Natural Resource Conservation Commission Preliminary Assessment/Site Inspection Program (FY 2000 and 2001)</i> . October 1999. 143 pages/w attachments.
9.	U.S. Environmental Protection Agency. Office of Emergency and Remedial Response, Quick Reference Fact Sheet (5204G), <i>Using Qualified Data to Document an Observed Release and Observed Contamination</i> . EPA 540-F-95-033. OSWER 9285-7-14FS. PB95-963320. November 1996. 18 pages.
10.	U.S. Environmental Protection Agency, Screening Site Inspection Field Log Book notes and photographs. March 27 - 30, 2000. 70 pages.

REFERENCE LISTING (continued)

<u>Reference Number</u>	<u>Description of the Reference</u>
11.	Texas Department of Transportation. County Maps of Texas, 1994. General High-way Map of Harris County, Texas, revised to January 1, 1994 data. Dated 1992. (Site location and 1-mile radius notations added by TNRCC). page 102. (Figure 2). 2 pages
12.	U.S. Environmental Protection Agency, Region 6, Houston Branch, <i>Case Number 27912, Sample Designation Group MFHM71, CLP Data Review and Inorganic Regional Data Assessment Package</i> . From: Marvelyn Humphrey, Alt. ESATRPO, 6MD-HC, To: B. Rhotenberry, 6SF-RA. May 25, 2000. 25 pages.
13.	U.S. Environmental Protection Agency, Region 6, Houston Branch, <i>Case Number 27912, Sample Designation Group MFHW65, CLP Data Review and Inorganic Regional Data Assessment Package</i> . From: Marvelyn Humphrey, Alternate ESAT RPO, 6MD-HC, To: B. Rhotenberry, 6SF-RA. June 8, 2000. 31 pages.
14.	U.S. Environmental Protection Agency, Region 6, Houston Branch, <i>Case Number 27912, Sample Designation Group FGA73, CLP Data Review and Organic Regional Data Assessment Package</i> . From: Marvelyn Humphrey, Alternate ESAT RPO, 6MD-HC, To: B. Rhotenberry, 6SF-RA. July 6, 2000. 145 pages.
15.	U.S. Environmental Protection Agency, Region 6, Houston Branch, <i>Case Number 27912, Sample Designation Group FGW45, CLP Data Review and Organic Regional Data Assessment Package</i> . From: Marvelyn Humphrey, Alternate ESAT RPO, 6MD-HC, To: B. Rhotenberry, 6SF-RA. July 6, 2000. 163 pages.
16.	U.S. Department of the Interior. National Wetlands Inventory map. La Port, Texas Quadrangle. 1995. 1 page.
17.	Texas Natural Resource Conservation Commission, Compliance Evaluation Inspection (CEI), and Boiler and Industrial Furnace (BIF) Inspection conducted on November 30 and December 3, 9 and 10, 1998, letters/w attachments. From: Aron Athavaley, Field Investigator, Region 12 Office, Houston, To: Files. January 12, 1999. 82 pages.
18.	Texas Natural Resource Conservation Commission, Comprehensive Monitoring Evaluation (CME) at: The Lubrizol Corporation, 41 Tidal Road, Deer Park (Harris County), Texas, letter/w attachments. From: Rama Yadav, Ph. D., P. E., Team Leader, Waste Section, Region 12 Office, Houston, To: Julius Rexer, Sr. Env. Eng., Lubrizol Corporation, Pasadena, Texas. August 16, 2000. 40 pages.

REFERENCE LISTING (continued)

<u>Reference Number</u>	<u>Description of the Reference</u>
19.	Texas Natural Resource Conservation Commission, Compliance Evaluation Inspection (CEI) conducted on November 2, 7 and 9, 1995, letter/w attachment. From Matthew Chun, Field Investigator, Region 12 Office, Houston, To: Files. December 13, 1995. 23 pages.
20.	Texas Natural Resource Conservation Commission, Patrick Bayou Site, Screening Site Inspection (SSI) Data Assessment. 7 pages.
21.	Texas Department of Health, Seafood Safety Division. <i>Fish Advisories and Bans, 1997</i> . 6 pages.

SOURCE DESCRIPTION

2.2 SOURCE CHARACTERIZATION

2.2.1 Source Identification

Number of the source: 1

Name and description of the source: Other (Contaminated Sediments)

The Patrick Bayou site Source 1 consists of contaminated sediments retained within the boundaries of Patrick Bayou and the East Fork tributary as illustrated in Figures 1b and 2 containing elevated heavy metals, volatile and semi-volatile organic compounds, pesticides and PCBs. The site was initially identified to the TNRCC from studies completed in 1993 and 1994 by the City of Houston investigating wastes accumulating within the Houston Ship Channel (HSC) and its tributaries from nearby petrochemical plants and accidental shipping spills (Ref. 4, p. 9). A July 26, 1994 TNRCC Region 12 Office follow-up investigation jointly sponsored by the EPA Region 6 Office confirmed initial findings and greatly expanded the area of documented contamination. During the 1994 investigation, eleven (11) sediment samples and a duplicate and five (5) surface water samples were collected from selected locations within Patrick Bayou, at an up-stream location before any identified outfall source, along the East Fork tributary and at the TNRCC routine water quality sampling station (TNRCC Station No. 1006.9150) located in the mouth of Patrick Bayou (Ref. 4, pp. 12, 28-32, 39 and 50). The 1994 selected sample station locations (marked prior sample stations) are shown in Figure 3. Sediment samples were analyzed for priority pollutants and water samples were tested for routine water quality parameters (Ref. 4, pp. 14 and 61-64).

The 1994 sample results revealed more than 40 percent of the sediment samples in Patrick Bayou exceeded either the TNRCC sediment screening levels (85th percentile for tidal streams, *TNRCC 1994a* and/or National Oceanic and Atmospheric Administration [NOAA] Effects-Range Low [ERL] and Effect-Range Median [ERM] values, *Long et al. 1995*) or the draft EPA Sediment Quality Guideline [SQG] values, *USEPA 1994*, that had been published for chromium, copper, lead, mercury, nickel, selenium, zinc, hexachlorobenzene, polychlorinated biphenyls (PCBs), and bis(2-ethylhexyl) phthalate (Ref. 4, pp. 2 and 15). Very high levels of **mercury** (8.3 mg/Kg at Station No. 3 shown in Figure 3), **hexachlorobenzene** (83,900 µg/Kg at Station No. 2), **hexachlorobutadiene** (138,000 µg/Kg at Station No. 2), **PCBs** (Aroclor 1248 4,150 µg/Kg at Station No. 7), **polynuclear aromatic hydrocarbons** (total PAHs 97,380 µg/ Kg at Station No. 3) and **lead** (269 mg/Kg at Station No. 9) were found within Patrick Bayou sediments (Ref. 4, pp. 44-45).

Lesser values of **acenaphthene**, **acenaphthylene**, **anthracene**, **benzo(a)anthracene**, **benzo(a)pyrene**, **chrysene**, **fluoranthene**, **fluorene**, **2-methylnaphthalene**, **naphthalene** and **pyrene** were also detected in sediments collected from Stations No. 1, 2, 2.5, 3, 7 and 9 that exceeded published NOAA ERM values indicating a significant accumulation of priority pollutants. The higher values and most significant number of pollutants were detected at sample Stations No. 3, 7 and 9 indicating contamination may be originating from a multitude locations along the entire bayou (Ref. 4, pp.

Figure 2

Site Features Map Patrick Bayou Site

A copy of the site location map is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

Figure 3

Sediment Sample Locations Patrick Bayou Site

A copy of the site location map is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

SD-Characterization and Containment
Source No. 1, Other (Contaminated Sediments)

28-32, 44-46 and 52-56). Based on prior studies and the 1994 sampling results, specific discharge sources for the contaminants of concern could not be sufficiently identified, but provided specific information on their potential sources (Ref. 4, p. 2). Therefore, this HRS Documentation Record will consider the identified contaminated sediments to: (1) have originated from historical accumulation within Patrick Bayou from a multitude of potential outfall/discharge sources and (2) they will be defined as “the source” for further waste characterization in this section.

Location of the source, with reference to a map of the site:

See Figure 1b, Site Location and Surrounding Land Use Map. The contaminated area within Patrick Bayou is identified as beginning at the combined storm water/outfall discharge drains (box culverts) near the Station No. 7/SE-17 sample location located approximately 1,800' north of SH 225 and ending just beyond the convergence of Patrick Bayou with the HSC and includes a portion of the East Fork tributary located just west of the railroad bridge beginning at the SE-14 sample location that is approximately 750' downstream from the Station No. 10 location shown in Figure 3. The contaminated area is described in more detail in Section 4.1.2.1.1 and the source was delineated using sample results presented in Table 6. The estimated lineal distance is approximately 10,100' (1.91 mi.) (Ref. 10, pp. 3, 11, 26 and 29).

Source type for HRS evaluation purposes: Other (Contaminated sediments).

Containment

Gas release to air: The air migration pathway was not evaluated; therefore, gas containment was not evaluated (Ref. 7, pp. 13 and 24).

Particulate release to air: The air migration pathway was not evaluated; therefore, particulate containment was not evaluated (Ref. 7, pp. 13 and 24).

Release to ground water: The ground water migration pathway with respect to the contaminated sediments was not evaluated for lack of identified ground water targets (Ref. 7, pp. 1 and 10).

Release via overland migration and/or flood: Source consists of contaminated sediments. There is no containment and no liner present to prevent the migration of hazardous substances from the contaminated sediments. Evidence of migration was based on elevated levels of contaminants detected throughout Patrick Bayou releasing to the adjacent HSC (as substantiated during the SSI) and for lack of any physical barrier or containment structure noted along the surface water migratory pathway (Ref. 10, pp. 3, 5, 6 and 8). Therefore, the contaminated sediments were assigned a containment factor value of 10 as specified in Table 4-2 of the HRS Rule (Ref. 1, Section 4.1.2.1.2.1.1).

2.2.2 Hazardous Substances Associated with a Source

Based on the results of the March 27-30, 2000 SSI, the source area is defined as the contaminated sediments within the HSC, the East Fork Tributary and Patrick Bayou. Table 1 below represents the eighteen (18) individual samples collected during the SSI that define the source area. For a complete list of hazardous substances that meet observed release criteria and their concentrations at each sample location, see Table 6.

Locations of samples are depicted in Figure 3.

TABLE 1

Source Description Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
CLP Sample ID	Sample ID No./Location	Sample/Depth	Date Collected	Location Reference
MFHW68 FGW48	SE-04/HSC sample Confluence of HSC and Patrick Bayou	Grab Sample 0"-18" deep	3/28/00	Figure 3 Ref. 10, pp. 9, 11, 16 Photos #13, 14
MFHW69 FGW49	SE-05/HSC sample Confluence of HSC and Patrick Bayou	Composite 0"-20" deep	3/28/00	Figure 3 Ref. 10, pp. 9, 11, 17 Photo #15
MFHW70 FGW50	SE-06/HSC sample Duplicate sample of SE-05 for QA/QC requirements.	Same as SE-05	3/28/00	Figure 3 Ref. 10, pp. 9, 11, 18 Photo #16
MFHW71 FGW51	SE-07/HSC sample Down-channel sample 300' west of OxyVinyl outfall	Grab Sample 0"-16" deep	3/28/00	Figure 3 Ref. 10, pp. 9, 11, 19 Photos #9, 10
MFHW72 FGW52	SE-08/HSC sample Down-channel sample 300' west of OxyVinyl outfall	Composite 0"-18" deep	3/28/00	Figure 3 Ref. 10, pp. 9, 11, 20 Photo #12
MFHW73 FGW53	SE-09/HSC sample Duplicate sample of SE-08 for QA/QC requirements.	Same as SE-08	3/28/00	Figure 3 Ref. 10, pp. 9, 11, 21 Photo #12
MFHW78 FGW58	SE-14/East Fork Tributary Near the confluence of East Fork with Patrick Bayou	Composite 0"-14" deep	3/30/00	Figure 3 Ref. 10, pp. 9, 11, 26 Photos #33, 34
Table 1 continued ...				

SD-Hazardous Substances
Source No. 1: Other (Contaminated Sediments)

TABLE 1 (continued)

Source Description Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
CLP Sample	Sample Location/Event	Sample Depth	Date Collected	Location Reference
MFHW81 FGW61	SE-17/Patrick Bayou 40 meters downstream from Lubrizol/Deer Park Outfall	Composite 0"-6" deep	3/30/00	Figure 3 Ref. 10, pp. 9, 11, 29 Photo #30
MFHW82 FGW62	SE-18/Patrick Bayou 20 meters downstream from Shell Road Bridge/west bank	Composite 0"-8" deep	3/30/00	Figure 3 Ref. 10, pp. 10, 11, 30 Photo #32
MFHW83 FGW63	SE-19/Patrick Bayou approx. 800' north of confluence with East Fork	Composite 0"-18" deep	3/30/00	Figure 3 Ref. 10, pp. 10, 11, 31 Photo #39, 40
MFHW84 FGW64	SE-20/Patrick Bayou 60 meters N. Oxyvinyl #001 24 meters from E. shoreline	Composite 0"-20" deep	3/29/00	Figure 3 Ref. 10, pp. 10, 11, 32 Photo #17
MFHW85 FGW65	SE-21/Patrick Bayou Duplicate sample of SE-20 for QA/QC requirements.	Same as SE-20.	3/29/00	Figure 3 Ref. 10, pp. 10, 11, 33 Photo #18
MFHW86 FGW66	SE-22/Patrick Bayou 45 meters S. Oxyvinyl #003 21 meters from E. shoreline	Composite 0"-18" deep	3/30/00	Figure 3 Ref. 10, pp. 10, 11, 34 Photo #25
MFHW87 FGW67	SE-23/Wetland sample 700' north of East Fork Along edge of east bank	Composite 0"-20" deep	3/30/00	Figure 3 Ref. 10, pp. 10, 11, 35 Photos #37, 38
MFHW88 FGW68	SE-24/Patrick Bayou 83 meters south of island 17 meters from E. shoreline	Composite 0"-16" deep	3/30/00	Figure 3 Ref. 10, pp. 10, 11, 36 Photos #21, 22
MFHW89 FGW69	SE-25/Wetland sample approx. 60' N. of SE-14 Along edge of east bank	Composite 0"-22" deep	3/30/00	Figure 3 Ref. 10, pp. 10, 11, 37 Photos #35, 36
MFHW90 FGW70	SE-26/Patrick Bayou approx. 200' E. of bridge in lower bayou area	Grab Sample 0"-18" deep	3/28/00	Figure 3 Ref. 10, pp. 10, 11, 38 Photo #26 (not avail)
Table 1 continued				

TABLE 1 (continued)

Source Description Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
CLP Sample	Sample Location/Event	Sample Depth	Date Collected	Location Reference
MFHW91 FGW71	SE-27/Wetland sample Along NE shoreline of island in Patrick Bayou	Composite 0"-15" deep	3/30/00	Figure 3 Ref. 10, pp. 10, 11, 39 Photo #19

Notes: QA/QC = Quality Assurance/Quality Control CLP = Contract Laboratory Procedures

Source samples SE-04 thru SE-09 in the Houston Ship Channel, SE-14 near the confluence with the East Fork tributary and SE-19 thru SE-27 within Patrick Bayou were all collected with a stainless steel sediment coring device. In addition, dedicated decontaminated stainless steel screw-on tips were used to hold clean polyethylene zero-contamination tubes within the device. Source sample SE-17 and SE-18 in the upper portion of Patrick Bayou were collected using clean dedicated stainless steel bowls and spoons instead of the sediment coring device (Ref. 10, pp. 29-30). Since the upper portion of the East Fork tributary is shallow containing many small rocks and gravel and the upper portion of Patrick Bayou is mostly gunite or concrete lined, obtaining sufficient volume using the coring sampling tool was determined unsuitable (Ref. 10, pp. 16-21 and 31-40). The source samples exhibited elevated concentrations of both inorganic and organic constituents.

All samples were collected according to the EPA approved state Quality Assurance Project Plan and sample locations were approved by the EPA prior to sample collection (Ref. 8, pp. 1-52; Ref. 7, pp. 1-27).

2.2.3 Hazardous Substances Available to a Pathway

Because containment for this source is greater than 0, the following hazardous substances associated with the source can migrate via the surface water migration pathway:

Cadmium	Chromium	
Copper	Lead	
Manganese	Mercury	
Nickel	Silver	
Vanadium	Zinc	
Cyanide		
Carbon Disulfide	Cyclohexane	Benzene
Methylcyclohexane	Toluene	Chlorobenzene
Ethylbenzene	Xylenes (Total)	Isopropylbenzene
1,3-Dichlorobenzene	1,4-Dichlorobenzene	Hexachlorobutadiene
2-Methylnaphthalene	Hexachlorobenzene	Aldrin
Endosulfan I	Endrin	Aroclor 1248
Aroclor 1254	Aroclor 1260	

2.3 LIKELIHOOD OF RELEASE

Refer to Section 4.1.2.1 of this documentation record for specific information related to the Likelihood of Release to the Surface Water Pathway.

2.4 WASTE CHARACTERIZATION

2.4.1 Selection of Substance Potentially Posing Greatest Hazard

All of the hazardous substances listed above are associated with this source.

Specific toxicity factors, HRS Section 2.4.1.1 and selection of the hazardous substances with the highest factor values (toxicity, persistence, and bioaccumulation), HRS Section 2.4.1.2, are presented under the Surface Water Migration Pathway section of this documentation record report.

2.4.2 Hazardous Waste Quantity

2.4.2.1 Source Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity (Tier A) - Not Evaluated (NE)

The information available is not sufficient to evaluate Tier A, as required in Section 2.4.2.1.1 of the HRS Rule. As a result, the evaluation of Hazardous Waste Quantity proceeds to the evaluation of Tier B, hazardous waste stream quantity (Ref. 1).

2.4.2.1.2 Hazardous Wastestream Quantity (Tier B) - NE

The information available is not sufficient to evaluate Tier B, as required in Section 2.4.2.1.2 of the HRS Rule. Therefore, quantity is unknown, but greater than zero. As a result, the evaluation of Hazardous Waste Quantity proceeds to the evaluation of Tier C, volume (Ref. 1).

2.4.2.1.3 Volume (Tier C) - NE

The information available is not sufficient to evaluate Tier C, as required in Section 2.4.2.1.3 of the HRS Rule. As a result, the evaluation of Hazardous Waste Quantity proceeds to the evaluation of Tier D, area (Ref. 1).

2.4.2.1.4 Area (Tier D)

Tier D is not evaluated for source type “Other” (Ref. 1, Section 2.4.2.1.4, Table 2-5).

SD- Source Hazardous Waste Quantity
Source No. 1: Other (Contaminated Sediments)

Although the source volume was not adequately determined and its extent is unknown, the value is greater than 0, but unknown.

Dimension of source (yds³ or gallons): > 0, but unknown.

Reference(s): Ref. 1, Section 2.4.2.1.4, Table 2-5.

Volume Assigned Value: > 0, but unknown

2.4.2.1.5 Source Hazardous Waste Quantity Value

As described in the HRS Rule, the highest value assigned to a source from among the four tiers of hazardous constituent quantity (Tier A), hazardous wastestream quantity (Tier B), volume (Tier C) or area (Tier D) shall be selected as the source hazardous waste quantity value. (Ref. 1, Sections 2.4.2.1.1-4).

TABLE 2

Source No. 1 - Other (Contaminated Sediments) Source Hazardous Waste Quantity	
Tier Measure	Migration Pathway (Surface Water)
Tier A, Constituent Quantity	NE
Tier B, Wastestream Quantity	NE
Tier C, Volume	> 0, but unknown
Tier D, Area	NE

NE = not evaluated.

Source Hazardous Waste Quantity Value: > 0, but unknown

SITE SUMMARY OF SOURCE DESCRIPTIONS

TABLE 3

Source Number	Source Hazardous Waste Quantity Value	Containment			
		Ground Water	Surface Water	Gas	Air Particulate
1	> 0	Not Evaluated	10	Not Evaluated	Not Evaluated
Total	> 0, but unknown				

The sum of the Source No. 1 hazardous waste quantity of > 0 is assigned as the Source Hazardous Waste Quantity Value (Ref. 1, Section 2.4.2.2). The sum of the source hazardous waste quantity values for Patrick Bayou site, rounded to the nearest integer is > 0, but unknown.

The Hazardous Waste Quantity Factor Value assigned to a Source Hazardous Waste Quantity Value of > 0, but unknown is 100 (Ref. 1, Section 2.4.2.2).

[Note: See discussion under Section 4.1.4.3.1 of this report for rationale used to determine a Hazardous Waste Quantity Factor Value when a pathway target is subjected to Level I or Level II concentrations].

Source Hazardous Waste Quantity Value: > 0, but unknown

Hazardous Waste Quantity Factor Value: 100

3.0 GROUND WATER MIGRATION PATHWAY

3.0.1 General Considerations

Since the “site” is defined as the accumulated contaminated sediments within Patrick Bayou, the Groundwater and Groundwater to Surface Water Pathways will not be evaluated. The drinking water threat was not evaluated due to lack of targets and because the inclusion of this threat would not significantly effect the site score. The Surface Water Pathway will be evaluated to assess potential contaminant migration.

4.0 SURFACE WATER MIGRATION PATHWAY

4.1 OVERLAND/FLOOD MIGRATION COMPONENT

There were no ground water to surface water migration components identified located within the watershed being evaluated. Therefore, only the Overland/Flood Migration to Surface Water Component will be evaluated for the watershed of concern (Ref. 1, Section 4.1).

4.1.1 General Considerations

Patrick Bayou drains north then northeast discharging to Stream Segment 1006 of the San Jacinto River Basin (Houston Ship Channel Tidal) with the widest portion of Patrick Bayou entering the Houston Ship Channel (HSC) as shown in Figures 1b and 2 (Ref. 10, pp. 6 and 8). Stream Segment 1006 extends 6 miles easterly from a point located immediately upstream of Green Bayou in Harris County to its confluence with the main fork of the San Jacinto River (Ref. 5, p. 5). The tidal portion of the HSC is highly developed, industrialized and has allowed the City of Houston to become an international port (Ref. 4, p. 7; Ref. 5, p. 3). See Figure 4 for the location of Patrick Bayou and the HSC within Stream Segment 1006.

Segment 1006 is classified "Water Quality Limited" due to numerous water quality standard violations with advanced wastewater treatment required prior to any other intended use. Designated uses include: industrial water supply and navigation. Along this segment there are 88 domestic outfalls and 35 industrial outfalls with a total average daily discharge of 273.33 million gallons (Ref. 5, p. 5). A restricted-consumption advisory (AD-3, issued September 19, 1990) for the general population and a no-consumption advisory for children and women of childbearing age have been issued for the Houston Ship Channel and all contiguous waters and Upper Galveston Bay area by the Texas Department of Health due to elevated levels of dioxin in blue crabs and all species of catfish (Ref. 4, p. 13; Ref. 5, pp. 3-5; Ref. 21, pp. 5-6).

Segment 1006 drains east entering the lower portion of Stream Segment 1005 before discharging to Galveston Bay (Ref. 10, pp. 6 and 8). Segment 1005 begins upstream at a point located 100 meters (110 yds) downstream (south) of the Interstate Highway (IH) 10 bridge in Harris County and extends 12 miles southeast to its confluence with Galveston Bay at Morgan's Point located at the Harris/ Chambers County boundary line (Ref. 5, p. 7). See Figure 4 for the location of the lower portion of Stream Segment 1005.

Segment 1005 is also classified "Water Quality Limited" due to water quality standards violations with advanced waste treatment required. Designated water uses include: non-contact recreation and high aquatic life. Along this segment there is 1 domestic outfall and 14 industrial outfalls with a total average daily discharge of 37.14 million gallons (Ref. 5, p. 7). Segment 1005 has the same restricted-consumption advisory for the general population and a no-consumption advisory for children and women of childbearing age issued by the Texas Department of Health due to elevated levels of dioxin in blue crabs and all species of catfish (Ref. 5, p. 7; Ref. 21, pp. 5-6).

Figure 4

Surface Water Pathway Patrick Bayou Site

A copy of the site location map is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

4.1.1.1 Definition of Hazardous Substance Migration Path for Overland/Flood Migration Component

Overland Segment, Probable Point of Entries (PPEs), Number of Watersheds

As described in the HRS Rule, Section 4.1.1.1, there is no overland segment for hazardous substance migration from a source area that consists of contaminated sediments with no identified source, and the hazardous substance migration path consists solely of the in-water segment (Ref. 1). For the Patrick Bayou site, the source area begins at the two farthest upstream sample locations and continues to the most distant downstream sample location meeting observed release criteria. Since, for this site, the release to surface water defines the source and there is no overland route, and because all PPEs to the bayou have not been identified, it was determined more important to use the phrase “upper boundary” for the area of contaminated sediments instead of Probable Point of Entry (PPE). There are two (2) Upper Boundaries for this site identified as the farthest upstream sample location in Patrick Bayou (SE -17) designated as Upper Boundary No. 1 and the farthest upstream sample location in the East Fork tributary (SE-14) designated as Upper Boundary No. 2. In addition, as specified by the HRS Rule, since the two hazardous substance migration pathways associated with the upper boundaries reach a common point within the target distance limit, only one watershed will be evaluated for this documentation record report (Ref. 1, Section 4.1.1.1).

4.1.1.2 Target Distance Limit

As specified in the HRS Rule, Section 4.1.1.2, for sites consisting of contaminated sediments with no identified source, the in-water segment is defined as located between the two furthest observed release criteria sample locations (Ref. 1). Additionally, the HRS Rule specifies the target distance limit (TDL) for this same site with a clearly defined flow direction as the in-water segment measured from the furthest sample location upstream meeting observed release criteria to the most distant downstream sample location also meeting observed release criteria, or to the 15-mile down-stream distance, whichever is greater (Ref. 1).

For the Patrick Bayou site, the target distance limit was determined from a review of observed release criteria for the two farthest sampling locations identified within the surface water hazardous substance migration pathway. The furthest distance was determined as between sample locations SE-17 (Upper Boundary No. 1) located at the box channel discharge point in the upper portion of Patrick Bayou extending to the 15- mile TDL arc within Galveston Bay as shown in Figure 4.

Definition of In-Water Segments/Target Distance Limit

The Target Distance Limit (TDL) for this site is comprised of four (4) Hazard Ranking System (HRS) In-Water Segments which are included within two (2) State of Texas Water Quality Stream Segments. The components of these HRS In-Water segments are discussed below:

- (1) **In-Water Segment No. 1 (Upper Patrick Bayou to Confluence with HSC) - Level II:**
(approximately 1.91 miles) is defined as the in-water distance from Upper Boundary No. 1

SWOF-Surface Water Overland/Flood Migration Pathway

(sample location SE-17) along Patrick Bayou to its confluence with the HSC and includes a portion of the lower East Fork Tributary. The entire segment comprises the Patrick Bayou source site and is located within Stream Segment 1006 (Houston Ship Channel Tidal) of the San Jacinto River Basin (Figure 4; Ref. 10, p. 8; Ref. 5, pp. 3-5).

(2) In-Water Segment No. 2 (Confluence with Patrick Bayou to Confluence with San Jacinto River) - Potential: (approximately 2.5 miles) is defined as the in-water distance along the HSC from the confluence with Patrick Bayou to the confluence with the main fork of the San Jacinto River. The entire segment is located within Stream Segment 1006 (HSC Tidal) of the San Jacinto River Basin (Figure 4; Ref. 10, p. 8; Ref. 5, pp. 3-5).

(3) In-Water Segment No. 3 (Confluence with San Jacinto River to Galveston Bay) - Potential: (approximately 9.5 miles) is defined as the in-water distance along the main fork of the San Jacinto River from its confluence with the HSC to Morgan's Point at the entrance to Galveston Bay. The entire segment is located within Stream Segment 1005 (HSC/San Jacinto River Tidal) of the San Jacinto River Basin (Figure 4; Ref. 10, p. 8; Ref. 5, pp. 3-5).

(4) In-Water Segment No. 4 (Galveston Bay to the 15-Mile Arc) - Potential: (approximately 1.0 miles) is defined as the in-water area within an arc extending past Morgan's Point into Galveston Bay (Figure 4; Ref. 10, p. 8; Ref. 5, pp. 3-5).

4.1.1.3 Evaluation of Overland/Flood Migration Component

As described in the HRS Rule, Section 4.1.1.3, since there is only one watershed area, the resulting score for that watershed will become the overland/flood migration component score for the site. In addition, since there were no drinking water targets identified within the defined TDL, the overland/flood migration component will be evaluated for human food chain and environmental threats based on three factor categories: likelihood of release, waste characteristics and targets. The resulting Overland/Flood Migration pathway score will be used to evaluate the Surface Water Migration Pathway site score (Ref. 1; Ref. 10, pp. 6 and 8).

4.1.2 Drinking Water Threat

The drinking water threat was not evaluated due to lack of significant drinking water targets located along the overland/flood migration pathway within the identified TDL. Documentation for an observed release follows, then evaluation will proceed to HRS Rule, Sections 4.1.3 and 4.1.4 for evaluation of the human food chain and environmental threats (Ref. 1).

4.1.2.1 Drinking Water Threat - Likelihood of Release

4.1.2.1.1 Observed Release

An observed release can be documented in the HRS system by two methods: (a) direct observation and (b) chemical analysis (Ref. 1). The chemical analysis method was used for this report.

Chemical Analysis

Establishing an observed release by chemical analysis requires attributing the hazardous substances to the site. First, naturally occurring background concentrations of the hazardous substances must be determined. Second, it must be demonstrated that the concentrations of the hazardous substances in a release sample are significantly above the highest identified background level and some portion of the significant increase must be attributed to the site. In order to document a significant increase above background levels, the hazardous substances must be present in concentrations of at least three times (3x) above the appropriate background level if the hazardous substances are present in the background sample. Or, if the hazardous substances have not been detected in the background samples, then the hazardous substances must be present at concentrations both above the release's and the highest background samples' laboratory Sample Quantitation Limit (SQL) (Ref. 1, Section 2.3).

Background Concentrations

A total of eight (8) background samples were collected at up-channel locations along the HSC, along Patrick Bayou and the East Fork Tributary upstream from known outfall locations for identification of site contaminants (Ref. 7, pp. 12, 18-19, 21, 23). Table 4 provides a summary of the background samples collected for the SSI and Table 5 indicates the highest designated background levels for the inorganic and organic hazardous substances of concern for the site. A variety of background locations were selected to adequately represent differing surface conditions and flow characteristics encountered at the site. These conditions included varying types of flow channels, sediment conditions and a wide range of surface water flow characteristics found within the East Fork Tributary, upper drainage area of Patrick Bayou and along the Houston Ship Channel. Another bayou was not selected for unaffected background sediment samples since previous studies conducted by the City of Houston within the HSC system indicated elevated toxic substances and water quality problems within all nine tributaries (Ref. 4, p. 1).

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

Background samples SE-01, SE-02 and SE-03 were selected to represent typical sediment locations identified within the Patrick Bayou-HSC confluence area with similar large tributary flow characteristics. Background samples were collected using a sediment coring sampling tool along the shoreline of the Houston Ship Channel in shallow areas where sediments would collect up-channel of the confluence with Patrick Bayou. SE-01 was a composite sample so that there would be sufficient volume for a requested split sample. The coring sampling tool was pushed as far as it could be pushed into the sediments to collect each sample (Ref. 10, pp. 13-15).

TABLE 4

Surface Water Pathway Background Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
CLP Sample ID	Sample Location/Event	Sample Depth	Date Collected	Location Reference
MFHW65 FGW45	SE-01/HSC sample HSC up-channel from Patrick Bayou	Composite 0"-18" deep	3/28/00	Figure 3, Ref. 10, pp. 9, 11, 13 Photo #6
MFHW66 FGW46	SE-02/HSC sample HSC up-channel from Patrick Bayou	Grab sample 0"-20" deep	3/28/00	Figure 3, Ref. 10, pp. 9, 11, 14 Photo #7
MFHW67 FGW47	SE-03/HSC sample HSC up-channel from Patrick Bayou	Grab sample 0"-18" deep	3/28/00	Figure 3, Ref. 10, pp. 9, 11, 15 Photo #8
MFHW74 FGW54	SE-10/East Fork sample Upstream from Praxair outfall entry to tributary	Grab sample 0"-8" deep	3/28/00	Figure 3, Ref. 10, pp. 9, 11, 22 Photo #49
MFHW75 FGW55	SE-11/East Fork sample Upstream from Praxair outfall entry to tributary	Grab sample 0"-8" deep	3/28/00	Figure 3, Ref. 10, pp. 9, 11, 23 Photo #48
MFHW76 FGW56	SE-12/East Fork sample Upstream from Praxair outfall entry to tributary	Grab sample 0"-10" deep	3/28/00	Figure 3, Ref. 10, pp. 9, 11, 24 Photo #47
MFHW79 FGW59	SE-15/Patrick Bayou Upstream from Deer Park wastewater discharge point	Composite 0"-4" deep	3/30/00	Figure 3 Ref. 10, pp. 9, 11, 27 Photo #27
MFHW80 FGW60	SE-16/Patrick Bayou Duplicate sample of SE-15 for QA/QC requirements.	Same as SE-15	3/30/00	Figure 3 Ref. 10, pp. 9, 11, 28 Photos #27

Notes: QA/QC = Quality Assurance/Quality Control

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

Background sample locations SE-10, SE-11 and SE-12 were selected along the upper portions of the East Fork Tributary upstream of any known outfall source in shallow intermittent low-flow locations typical of sediment locations noted located below outfall sources within the East Fork Tributary. Since the shallow stream channel contained many small rocks and gravel and the underlying soils

Background sample location SE-15 with duplicate sample SE-16 was selected within the concrete-lined upper portion of Patrick Bayou upstream of any know outfall source to represent typical gunite-lined lower portions of the bayou located between sampling Stations No. 9 and No. 6 illustrated in Figure 3 and shown in Photo #29. Background sediment samples SE-15 and SE-16 were collected using a dedicated stainless steel bowl and spoon since the channel was concrete lined and using the coring sampling tool was determined unsuitable. A composite sample was collected from deposits up to 4" thick of fine sediments lying within typical low-flow portions of the channel within an approximate 20' radius to obtain sufficient volume for the duplicate sample. Leaves, twigs and other organic matter were removed before collecting the sample (Ref. 10, pp. 27-28).

TABLE 5

Surface Water Pathway Summary of Highest Inorganic and Organic Constituents Detected in Background Sediment Samples				
Inorganic Constituent and Cyanide	Station ID/ CLP No.	Highest Concentration [SQL] mg/Kg	3 x Highest Background Concentration mg/Kg	Reference
Cadmium	SE-16/MFHW80	0.63 [1.3]	1.89	Ref. 12, pp. 1-7, 10-13, 17
Chromium	SE-16/MFHW80	12.4 [2.6]	37.2	Ref. 12, pp. 1-7, 10-13, 17
Copper	SE-16/MFHW80	17.7 [6.5]	53.1	Ref. 12, pp. 1-7, 10-13, 17
Lead	SE-15/MFHW79	38.6 [0.9]	115.8	Ref. 12, pp. 1-7, 10-13, 16
Manganese	SE-16/MFHW80	207 [3.9]	621	Ref. 12, pp. 1-7, 10-13, 17
Mercury	SE-01/MFHW65	0.56J* [0.12]	1.68*	Ref. 12, pp. 1-7, 12-15, 26
Nickel	SE-11/MFHW75	11.5 [10.3]	34.5	Ref. 13, pp. 1-7, 12-15, 26
Table 5 continued ...				

ND = Not detected. Concentrations for these constituents were not detected at the reported quantitation limit in sediment samples.
[SQL] = The sample quantitation limit. SQL for metals is mg/Kg and the SQL for organics is µg/Kg. $SQL = (CRQL/CRDL) \times (df) / \% \text{ solids}$, where
 $\% \text{ solids} = [100 - \% \text{ moisture}] / 100$
J, J^, Jv = The value is estimated concentration because one or more of the quality control criteria have not been met. It is included to show that the substance has been qualitatively identified as present in this source. J^ indicates a high bias and Jv indicates a low bias.
M = Reported concentration should be used as a raised quantitation limit because of interferences and/or laboratory contamination.
N/A = Not applicable.
* = Adjusted result. See Data Usability Table 7.

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 5 (Continued)

Surface Water Pathway Summary of Highest Organic and Inorganic Constituents Detected in Background Sediment Samples				
Silver	SE-12/MFHW76	ND [0.33]	N/A [0.33]	Ref. 13, pp. 1-7, 12-15, 27
Vanadium	SE-16/MFHW80	27.7 [13.1]	83.1	Ref. 12, pp. 1-7, 10-13, 17
Zinc	SE-16/MFHW80	99.0 [5.2]	297	Ref. 12, pp. 1-7, 10-13, 17
Cyanide	SE-15/MFHW79	0.3Jv [1.45]	0.9	Ref. 12, pp. 1-7, 10-13, 16
Volatile Organic Constituent	Station ID/ CLP No.	Highest Concentration [SQL] µg/Kg	3 x Highest Background Concentration µg/Kg	Reference
Carbon Disulfide	SE-15/FGW59	NDMJ [35]	N/A [35]	Ref. 14, pp. 1-13, 26-34, 41-43
Cyclohexane	SE-12/FGW56	ND [19]	N/A [19]	Ref. 15, pp. 1-9, 23-30, 73-75
Benzene	SE-12/FGW56	ND [19]	N/A [19]	Ref. 15, pp. 1-9, 23-30, 73-75
Methylcyclohexane	SE-12/FGW56	ND [19]	N/A [19]	Ref. 15, pp. 1-9, 23-30, 73-75
Toluene	SE-12/FGW56	ND [19]	N/A [19]	Ref. 15, pp. 1-9, 23-30, 73-75
Chlorobenzene	SE-12/FGW56	ND [19]	N/A [19]	Ref. 15, pp. 1-9, 23-30, 73-75
Ethylbenzene	SE-12/FGW56	ND [19]	N/A [19]	Ref. 15, pp. 1-9, 23-30, 73-75
Xylenes (total)	SE-12/FGW56	ND [19]	N/A [19]	Ref. 15, pp. 1-9, 23-30, 73-75
Isopropylbenzene	SE-12/FGW56	ND [19]	N/A [19]	Ref. 15, pp. 1-9, 23-30, 73-75
1,3-Dichlorobenzene	SE-12/FGW56	ND [19]	N/A [19]	Ref. 15, pp. 1-9, 23-30, 73-75
1,4-Dichlorobenzene	SE-12/FGW56	ND [19]	N/A [19]	Ref. 15, pp. 1-9, 23-30, 73-75
Table 5 Continued ...				

ND = Not detected. Concentrations for these constituents were not detected at the reported quantitation limit in sediment samples.
[SQL] = The sample quantitation limit. SQL for metals is mg/Kg and the SQL for organics is µg/Kg. $SQL = (CRQL/CRDL) \times (df) / \% \text{ solids}$, where % solids = $[100 - \% \text{ moisture}] / 100$
J, J[^], Jv = The value is estimated concentration because one or more of the quality control criteria have not been met. It is included to show that the substance has been qualitatively identified as present in this source. J[^] indicates a high bias and Jv indicates a low bias.
M = Reported concentration should be used as a raised quantitation limit because of interferences and/or laboratory contamination.
N/A = Not applicable.
* = Adjusted result. See Data Usability Table 7.

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 5 (Continued)

Surface Water Pathway Summary of Highest Organic and Inorganic Constituents Detected in Background Sediment Samples				
Semivolatile Organic Constituent	Station ID/ CLP No.	Highest Concentration [SQL] µg/Kg	3 x Highest Background Concentration µg/Kg	Reference
Hexachlorobutadiene	SE-12/FGW56	ND [610]	N/A [610]	Ref. 15, pp.1-9, 23-30, 120-124
2-Methylnaphthalene	SE-12/FGW56	ND [610]	N/A [610]	Ref. 15, pp.1-9, 23-30, 120-124
Hexachlorobenzene	SE-12/FGW56	ND [610]	N/A [610]	Ref. 15, pp.1-9, 23-30, 120-124
Pesticide/PCB Constituent	Station ID/ CLP No.	Highest Concentration [SQL] µg/Kg	3 x Highest Background Concentration µg/Kg	Reference
Aldrin	SE-12/FGW56	NDJv [3.1]	N/A [3.1]	Ref. 15, pp. 1-9, 23-30, 157
Endosulfan I	SE-12/FGW56	NDJv [3.1]	N/A [3.1]	Ref. 15, pp. 1-9, 23-30, 157
Endrin	SE-12/FGW56	ND [6.1]	N/A [6.1]	Ref. 15, pp. 1-9, 23-30, 157
Aroclor 1248	SE-12/FGW56	ND [61]	N/A [61]	Ref. 15, pp. 1-9, 23-30, 157
Aroclor 1254	SE-12/FGW56	ND [61]	N/A [61]	Ref. 15, pp. 1-9, 23-30, 157
Aroclor 1260	SE-12/FGW56	ND [61]	N/A [61]	Ref. 15, pp. 1-9, 23-30, 157

ND = Not detected. Concentrations for these constituents were not detected at the reported quantitation limit in sediment samples.
[SQL] = The sample quantitation limit. SQL for metals is mg/Kg and the SQL for organics is µg/Kg. $SQL = (CRQL/CRDL) \times (df) / \% \text{ solids}$,
where $\% \text{ solids} = [100 - \% \text{ moisture}] / 100$
J, J[^], J_v = The value is estimated concentration because one or more of the quality control criteria have not been met. It is included to show
that the substance has been qualitatively identified as present in this source. J[^] indicates a high bias and J_v indicates a low bias.
M = Reported concentration should be used as a raised quantitation limit because of interferences and/or laboratory contamination.
N/A = Not applicable.
* = Adjusted result. See Data Usability Table 7.

A complete listing of all background values is included as Reference 20.

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

All samples were collected according to the EPA approved state Quality Assurance Project Plan and sample locations were approved by the EPA prior to sample collection (Ref. 8, pp. 1-52; Ref. 7, pp. 1-27).

Contaminated Samples

The following samples meet the observed release criteria and are presented below indicating inorganic and organic hazardous substances with their concentrations and SQLs.

The following samples were qualified as “releases” based on the criteria outlined in the HRS Rule, Section 2.3 and Table 2-3 (Ref. 1).

TABLE 6

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
CLP Sample ID	Sample Location/Event	Sample Depth	Date Collected	Location Reference
MFHW68 FGW48	SE-04/HSC sample Confluence of HSC and Patrick Bayou	Grab Sample 0"-18" deep	3/28/00	Figure 3, Ref. 10, pp. 9, 11, 16 Photos #13, 14
MFHW69 FGW49	SE-05/HSC sample Confluence of HSC and Patrick Bayou	Composite 0"-20" deep	3/28/00	Figure 3, Ref. 10, pp. 9, 11, 17 Photo #15
MFHW70 FGW50	SE-06/HSC sample Duplicate sample of SE-05 for QA/QC requirements.	Same as SE-05	3/28/00	Figure 3, Ref. 10, pp. 9, 11, 18 Photo #16
MFHW71 FGW51	SE-07/HSC sample Down-channel sample 300' west of OxyVinyl outfall	Grab sample 0"-16" deep	3/28/00	Figure 3, Ref. 10, pp. 9, 11, 19 Photos #9, 10
MFHW72 FGW52	SE-08/HSC sample Down-channel sample 300' W. of OxyVinyl outfall	Composite 0"-18" deep	3/28/00	Figure 3, Ref. 10, pp. 9, 11, 20 Photo #12
Table 6 continued ...				

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
CLP Sample ID	Sample ID No./Location	Sample/Depth	Date Collected	Location Reference
MFHW73 FGW53	SE-09/HSC sample Duplicate sample of SE-08 for QA/QC requirements.	Same as SE-08	3/28/00	Figure 3, Ref. 10, pp. 9, 11, 21 Photo #12
MFHW78 FGW58	SE-14/East Fork Tributary Near the confluence of East Fork with Patrick Bayou	Composite 0"-14" deep	3/30/00	Figure 3 Ref. 10, pp. 9, 11, 26 Photos #33, 34
MFHW81 FGW61	SE-17/Patrick Bayou 40 meters downstream from Lubrizol/Deer Park Outfall	Composite 0"-6" deep	3/30/00	Figure 3 Ref. 10, pp. 9, 11, 29 Photo #30
MFHW82 FGW62	SE-18/Patrick Bayou 20 meters downstream from Shell Road Bridge/west bank	Composite 0"-8" deep	3/30/00	Figure 3 Ref. 10, pp. 10, 11, 30 Photo #32
MFHW83 FGW63	SE-19/Patrick Bayou approx. 800' north of confluence with East Fork	Composite 0"-18" deep	3/30/00	Figure 3 Ref. 10, pp. 10, 11, 31 Photos #39, 40
MFHW84 FGW64	SE-20/Patrick Bayou 60 meters N. Oxyvinyl #001 24 meters from E. shoreline	Composite 0"-20" deep	3/29/00	Figure 3 Ref. 10, pp. 10, 11, 32 Photo #17
MFHW85 FGW65	SE-21/Patrick Bayou Duplicate sample of SE-20 for QA/QC requirements.	Same as SE- 20.	3/29/00	Figure 3 Ref. 10, pp. 10, 11, 33 Photo #18
MFHW86 FGW66	SE-22/Patrick Bayou 45 meters S. Oxyvinyl #003 21 meters from E. shoreline	Composite 0"-18" deep	3/30/00	Figure 3 Ref. 10, pp. 10, 11, 34 Photo #25
MFHW87 FGW68	SE-23/Wetland sample 700' north of East Fork Along edge of east bank	Composite 0"-20" deep	3/30/00	Figure 3 Ref. 10, pp. 10, 11, 35 Photo #37, 38
MFHW88 FGW68	SE-24/Patrick Bayou 83 meters south of island 17 meters from E. shoreline	Composite 0"-16" deep	3/30/00	Figure 3 Ref. 10, pp. 10, 11, 36 Photo #21, 22
Table 6 continued ...				

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
CLP Sample ID	Sample ID No./Location	Sample/Depth	Date Collected	Location Reference
MFHW89 FGW69	SE-25/Wetland sample approx. 60' N. of SE-14 Along edge of east bank	Composite 0"-22" deep	3/30/00	Figure 3 Ref. 10, pp. 10, 11, 37 Photo #35, 36
MFHW90 FGW70	SE-26/Patrick Bayou approx. 200' E. of bridge in lower bayou area	Grab Sample 0"-18" deep	3/28/00	Figure 3 Ref. 10, pp. 10, 11, 38 Photo #26 (not avail)
MFHW91 FGW71	SE-27/Wetland sample Along NE shoreline of island in Patrick Bayou	Composite 0"-15" deep	3/30/00	Figure 3 Ref. 10, pp. 10, 11, 39 Photo #19
Table 6 continued ...				

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
Sample Location/ CLP ID	Hazardous Substance	Concentration	[SQL]	Reference
SE-04 MFHW68 Inorganics	Cadmium	0.93L mg/Kg	[1.9]	Ref. 13, pp. 1-7, 12-15, 19
	Chromium	183 mg/Kg	[3.8]	Ref. 13, pp. 1-7, 12-15, 19
	Copper	99.3 mg/Kg	[9.7]	Ref. 13, pp. 1-7, 12-15, 19
	Lead	117 mg/Kg	[1.2]	Ref. 13, pp. 1-7, 12-15, 19
	Manganese	172 mg/Kg	[5.8]	Ref. 13, pp. 1-7, 12-15, 19
	Mercury	11.31* mg/Kg	[0.19]	Ref. 13, pp. 1-7, 12-15, 19
	Nickel	51.2 mg/Kg	[15.5]	Ref. 13, pp. 1-7, 12-15, 19
	Silver	ND	[3.8]	Ref. 13, pp. 1-7, 12-15, 19
	Vanadium	11.9L mg/Kg	[19.4]	Ref. 13, pp. 1-7, 12-15, 19
	Zinc	334 mg/Kg	[7.8]	Ref. 13, pp. 1-7, 12-15, 19
	Cyanide	ND	[1.9]	Ref. 13, pp. 1-7, 12-15, 19
SE-04 FGW48 Volatiles	Carbon Disulfide	59B µg/Kg	[20]	Ref. 15, pp. 1-9, 23-30, 43
	Cyclohexane	ND	[20]	Ref. 15, pp. 1-9, 23-30, 43
	Benzene	170 µg/Kg	[20]	Ref. 15, pp. 1-9, 23-30, 43
	Methylcyclohexane	110 µg/Kg	[20]	Ref. 15, pp. 1-9, 23-30, 43
	Toluene	75 µg/Kg	[20]	Ref. 15, pp. 1-9, 23-30, 43
	Chlorobenzene	220 µg/Kg	[20]	Ref. 15, pp. 1-9, 23-30, 44
	Ethylbenzene	52 µg/Kg	[20]	Ref. 15, pp. 1-9, 23-30, 44
	Xylenes (total)	310 µg/Kg	[20]	Ref. 15, pp. 1-9, 23-30, 44
	Isopropylbenzene	290 µg/Kg	[20]	Ref. 15, pp. 1-9, 23-30, 44
	1,3-Dichlorobenzene	1,900 µg/Kg	[100]	Ref. 15, pp. 1-9, 23-30, 44
	1,4-Dichlorobenzene	260 µg/Kg	[20]	Ref. 15, pp. 1-9, 23-30, 44
Table 6 continued ...				

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
Sample Location/ CLP ID	Hazardous Substance	Concentration	[SQL]	Reference
SE-04 FGW48 Semivolatiles	Hexachlorobutadiene	19,000 µg/Kg	[16,000]	Ref. 15, pp. 1-9, 23-30, 100
	2-Methylnaphthalene	2,800LJ µg/Kg	[16,000]	Ref. 15, pp. 1-9, 23-30, 100
	Hexachlorobenzene	3,900J µg/Kg	[16,000]	Ref. 15, pp. 1-9, 23-30, 101
SE-04 FGW48 Pesticides/PCBs	Aldrin	NDMJ	[240]	Ref. 15, pp. 1-9, 23-30, 145
	Endrin	9.2J* µg/Kg	[66]	Ref. 15, pp. 1-9, 23-30, 145
	Aroclor-1248	5,200 µg/Kg	[66]	Ref. 15, pp. 1-9, 23-30, 145
	Aroclor-1254	ND	[660]	Ref. 15, pp. 1-9, 23-30, 145
	Aroclor-1260	ND	[660]	Ref. 15, pp. 1-9, 23-30, 145

ND = Not detected. Concentrations for these constituents were not detected at the reported quantitation limit in sediment samples.

[SQL] = The sample quantitation limit. SQL for metals is mg/Kg and the SQL for organics is µg/Kg. $SQL = (CRQL/CRDL) \times (df) / \% \text{ solids}$, where $\% \text{ solids} = [100 - \% \text{ moisture}] / 100$

J, J[^], J_v = The value is an estimated concentration because one or more of the quality control criteria have not been met. It is included to show that the substance has been qualitatively identified as present in this sample. J[^] indicates a high bias and J_v indicates a low bias.

IDL = Instrument detection limit.

L = Reported concentration is between the IDL and CRDL.

CRDL = Contract required detection limit.

M = Reported concentration should be used as a raised quantitation limit because of interferences and/or laboratory contamination.

N = Identification is tentative.

T = Identification is questionable because of absence of other commonly coexisting pesticides.

Shaded samples = The sample met observed release criteria for that hazardous substance.

* = Adjusted result. See Data Usability Table 7.

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
Sample Location/ CLP ID	Hazardous Substance	Concentration	[SQL]	Reference
SE-05 MFHW69 Inorganics	Cadmium	1.5L mg/Kg	[2.0]	Ref. 13, pp. 1-7, 12-15, 20
	Chromium	158 mg/Kg	[4.0]	Ref. 13, pp. 1-7, 12-15, 20
	Copper	69.7 mg/Kg	[10.4]	Ref. 13, pp. 1-7, 12-15, 20
	Lead	85.9 mg/Kg	[1.2]	Ref. 13, pp. 1-7, 12-15, 20
	Manganese	166 mg/Kg	[6.2]	Ref. 13, pp. 1-7, 12-15, 20
	Mercury	6.61J* mg/Kg	[0.2]	Ref. 13, pp. 1-7, 12-15, 20
	Nickel	38.3 mg/Kg	[16.6]	Ref. 13, pp. 1-7, 12-15, 20
	Silver	ND	[4.0]	Ref. 13, pp. 1-7, 12-15, 20
	Vanadium	11.1L mg/Kg	[20.8]	Ref. 13, pp. 1-7, 12-15, 20
	Zinc	307 mg/Kg	[8.3]	Ref. 13, pp. 1-7, 12-15, 20
	Cyanide	ND	[2.1]	Ref. 13, pp. 1-7, 12-15, 20
SE-05 FGW49 Volatiles	Carbon Disulfide	NDM	[250]	Ref. 15, pp. 1-9, 23-30, 49
	Cyclohexane	ND	[110]	Ref. 15, pp. 1-9, 23-30, 49
	Benzene	68Jv µg/Kg	[110]	Ref. 15, pp. 1-9, 23-30, 49
	Methylcyclohexane	98Jv µg/Kg	[110]	Ref. 15, pp. 1-9, 23-30, 49
	Toluene	21Jv µg/Kg	[110]	Ref. 15, pp. 1-9, 23-30, 49
	Chlorobenzene	200Jv µg/Kg	[110]	Ref. 15, pp. 1-9, 23-30, 50
	Ethylbenzene	30Jv µg/Kg	[110]	Ref. 15, pp. 1-9, 23-30, 50
	Xylenes (total)	110Jv µg/Kg	[110]	Ref. 15, pp. 1-9, 23-30, 50
	Isopropylbenzene	180Jv µg/Kg	[110]	Ref. 15, pp. 1-9, 23-30, 50
	1,3-Dichlorobenzene	1,300 µg/Kg	[110]	Ref. 15, pp. 1-9, 23-30, 50
	1,4-Dichlorobenzene	320Jv µg/Kg	[110]	Ref. 15, pp. 1-9, 23-30, 50
SE-05 FGW49 Semivolatiles	Hexachlorobutadiene	19,000 µg/Kg	[15,000]	Ref. 15, pp. 1-9, 23-30, 103
	2-Methylnaphthalene	1,600LJ µg/Kg	[15,000]	Ref. 15, pp. 1-9, 23-30, 103
Table 6 (Continued)				

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
SE-05 FGW49 Semivolatiles	Hexachlorobenzene	4,800J µg/Kg	[15,000]	Ref. 15, pp. 1-9, 23-30, 104
SE-05 FGW49 Pesticides/PCBs	Aldrin	NDM	[210]	Ref. 15, pp. 1-9, 23-30, 147
	Endosulfan I	3.3J µg/Kg	[3.9]	Ref. 15, pp. 1-9, 23-30, 147
	Endrin	ND	[75]	Ref. 15, pp. 1-9, 23-30, 147
	Aroclor-1248	4,500 µg/Kg	[75]	Ref. 15, pp. 1-9, 23-30, 147
	Aroclor-1254	ND	[750]	Ref. 15, pp. 1-9, 23-30, 147
	Aroclor-1260	180J* µg/Kg	[75]	Ref. 15, pp. 1-9, 23-30, 147

ND = Not detected. Concentrations for these constituents were not detected at the reported quantitation limit in sediment samples.

[SQL] = The sample quantitation limit. SQL for metals is mg/Kg and the SQL for organics is µg/Kg. $SQL = (CRQL/CRDL) \times (df) / \% \text{ solids}$, where % solids = $[100 - \% \text{ moisture}] / 100$

J, J[^], J_v = The value is an estimated concentration because one or more of the quality control criteria have not been met. It is included to show that the substance has been qualitatively identified as present in this sample. J[^] indicates a high bias and J_v indicates a low bias.

IDL = Instrument detection limit.

L = Reported concentration is between the IDL and CRDL.

CRDL = Contract required detection limit.

M = Reported concentration should be used as a raised quantitation limit because of interferences and/or laboratory contamination.

N = Identification is tentative.

T = Identification is questionable because of absence of other commonly coexisting pesticides.

Shaded samples = The sample met observed release criteria for that hazardous substance.

* = Adjusted result. See Data Usability Table 7.

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
Sample Location/ CLP ID	Hazardous Substance	Concentration	[SQL]	Reference
SE-06 MFHW70 Inorganics	Cadmium	0.96L mg/Kg	[2.2]	Ref. 13, pp. 1-7, 12-15, 21
	Chromium	164 mg/Kg	[4.4]	Ref. 13, pp. 1-7, 12-15, 21
	Copper	86.2 mg/Kg	[10.8]	Ref. 13, pp. 1-7, 12-15, 21
	Lead	95.6 mg/Kg	[1.3]	Ref. 13, pp. 1-7, 12-15, 21
	Manganese	160 mg/Kg	[6.5]	Ref. 13, pp. 1-7, 12-15, 21
	Mercury	22.68J* mg/Kg	[0.22]	Ref. 13, pp. 1-7, 12-15, 21
	Nickel	43.6 mg/Kg	[17.3]	Ref. 13, pp. 1-7, 12-15, 21
	Silver	ND	[4.4]	Ref. 13, pp. 1-7, 12-15, 21
	Vanadium	13.7L mg/Kg	[21.6]	Ref. 13, pp. 1-7, 12-15, 21
	Zinc	322 mg/Kg	[8.7]	Ref. 13, pp. 1-7, 12-15, 21
	Cyanide	ND	[2.2]	Ref. 13, pp. 1-7, 12-15, 21
SE-06 FGW50 Volatiles	Carbon Disulfide	NDMJ	[180]	Ref. 15, pp. 1-9, 23-30, 52
	Cyclohexane	ND	[100]	Ref. 15, pp. 1-9, 23-30, 52
	Benzene	147.2J^* µg/Kg	[100]	Ref. 15, pp. 1-9, 23-30, 52
	Methylcyclohexane	340J^ µg/Kg	[100]	Ref. 15, pp. 1-9, 23-30, 52
	Toluene	92J^* µg/Kg	[100]	Ref. 15, pp. 1-9, 23-30, 52
	Chlorobenzene	335J^* µg/Kg	[100]	Ref. 15, pp. 1-9, 23-30, 53
	Ethylbenzene	15J^* µg/Kg	[100]	Ref. 15, pp. 1-9, 23-30, 53
	Xylenes (total)	78J^* µg/Kg	[100]	Ref. 15, pp. 1-9, 23-30, 53
	Isopropylbenzene	680J^ µg/Kg	[100]	Ref. 15, pp. 1-9, 23-30, 53
	1,3-Dichlorobenzene	1,700 µg/Kg	[1,000]	Ref. 15, pp. 1-9, 23-30, 53
	1,4-Dichlorobenzene	820J^ µg/Kg	[110]	Ref. 15, pp. 1-9, 23-30, 53
Table 6 (Continued)				

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
SE-06 FGW50 Semivolatiles	Hexachlorobutadiene	21,000 µg/Kg	[14,000]	Ref. 15, pp. 1-9, 23-30, 106
	2-Methylnaphthalene	1,800J µg/Kg	[14,000]	Ref. 15, pp. 1-9, 23-30, 106
	Hexachlorobenzene	4,800J µg/Kg	[14,000]	Ref. 15, pp. 1-9, 23-30, 107
SE-06 FGW50 Pesticides/PCBs	Aldrin	NDMJ	[170]	Ref. 15, pp. 1-9, 23-30, 149-50
	Endosulfan I	ND	[35]	Ref. 15, pp. 1-9, 23-30, 149-50
	Endrin	ND	[69]	Ref. 15, pp. 1-9, 23-30, 149-50
	Aroclor-1248	380J* µg/Kg	[69]	Ref. 15, pp. 1-9, 23-30, 149-50
	Aroclor-1254	ND	[690]	Ref. 15, pp. 1-9, 23-30, 149-50
	Aroclor-1260	210J* µg/Kg	[69]	Ref. 15, pp. 1-9, 23-30, 149-50

ND = Not detected. Concentrations for these constituents were not detected at the reported quantitation limit in sediment samples.

[SQL] = The sample quantitation limit. SQL for metals is mg/Kg and the SQL for organics is µg/Kg. $SQL = (CRQL/CRDL) \times (df) / \% \text{ solids}$, where % solids = $[100 - \% \text{ moisture}] / 100$

J, J[^], J_v = The value is an estimated concentration because one or more of the quality control criteria have not been met. It is included to show that the substance has been qualitatively identified as present in this sample. J[^] indicates a high bias and J_v indicates a low bias.

IDL = Instrument detection limit.

L = Reported concentration is between the IDL and CRDL.

CRDL = Contract required detection limit.

M = Reported concentration should be used as a raised quantitation limit because of interferences and/or laboratory contamination.

N = Identification is tentative.

T = Identification is questionable because of absence of other commonly coexisting pesticides.

Shaded samples = The sample met observed release criteria for that hazardous substance.

* = Adjusted result. See Data Usability Table 7.

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
Sample Location/ CLP ID	Hazardous Substance	Concentration	[SQL]	Reference
SE-07 MFHW71 Inorganics	Cadmium	0.43L mg/Kg	[1.4]	Ref. 13, pp. 1-7, 12-15, 22
	Chromium	48.8 mg/Kg	[2.8]	Ref. 13, pp. 1-7, 12-15, 22
	Copper	25.2 mg/Kg	[7.0]	Ref. 13, pp. 1-7, 12-15, 22
	Lead	47.1 mg/Kg	[0.84]	Ref. 13, pp. 1-7, 12-15, 22
	Manganese	92.6 mg/Kg	[4.2]	Ref. 13, pp. 1-7, 12-15, 22
	Mercury	1.42J* mg/Kg	[0.14]	Ref. 13, pp. 1-7, 12-15, 22
	Nickel	29.2 mg/Kg	[11.2]	Ref. 13, pp. 1-7, 12-15, 22
	Silver	ND	[2.8]	Ref. 13, pp. 1-7, 12-15, 22
	Vanadium	9.7L mg/Kg	[14.0]	Ref. 13, pp. 1-7, 12-15, 22
	Zinc	123 mg/Kg	[5.6]	Ref. 13, pp. 1-7, 12-15, 22
	Cyanide	1.1 mg/Kg	[1.4]	Ref. 13, pp. 1-7, 12-15, 22
SE-07 FGW51 Volatiles	Carbon Disulfide	NDMJ	[80]	Ref. 15, pp. 1-9, 23-30, 58
	Cyclohexane	ND	[72]	Ref. 15, pp. 1-9, 23-30, 58
	Benzene	150 µg/Kg	[72]	Ref. 15, pp. 1-9, 23-30, 58
	Methylcyclohexane	9J µg/Kg	[72]	Ref. 15, pp. 1-9, 23-30, 58
	Toluene	22J µg/Kg	[72]	Ref. 15, pp. 1-9, 23-30, 58
	Chlorobenzene	550J^* µg/Kg	[720]	Ref. 15, pp. 1-9, 23-30, 59
	Ethylbenzene	7J µg/Kg	[72]	Ref. 15, pp. 1-9, 23-30, 59
	Xylenes (total)	34J µg/Kg	[72]	Ref. 15, pp. 1-9, 23-30, 59
	Isopropylbenzene	16J µg/Kg	[72]	Ref. 15, pp. 1-9, 23-30, 59
	1,3-Dichlorobenzene	1,700 µg/Kg	[720]	Ref. 15, pp. 1-9, 23-30, 59
	1,4-Dichlorobenzene	1,400 µg/Kg	[72]	Ref. 15, pp. 1-9, 23-30, 59
Table 6 (Continued)				

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
SE-07 FGW51 Semivolatiles	Hexachlorobutadiene	71,000 µg/Kg	[19,000]	Ref. 15, pp. 1-9, 23-30, 109
	2-Methylnaphthalene	450LJ µg/Kg	[1,900]	Ref. 15, pp. 1-9, 23-30, 109
	Hexachlorobenzene	40,000 µg/Kg	[19,000]	Ref. 15, pp. 1-9, 23-30, 110
SE-07 FGW51 Pesticides/PCBs	Aldrin	ND	[2.5]	Ref. 15, pp. 1-9, 23-30, 151
	Endosulfan I	ND	[2.5]	Ref. 15, pp. 1-9, 23-30, 151
	Endrin	ND	[4.8]	Ref. 15, pp. 1-9, 23-30, 151
	Aroclor-1248	ND	[48]	Ref. 15, pp. 1-9, 23-30, 151
	Aroclor-1254	32J* µg/Kg	[48]	Ref. 15, pp. 1-9, 23-30, 151
	Aroclor-1260	ND	[48]	Ref. 15, pp. 1-9, 23-30, 151

ND = Not detected. Concentrations for these constituents were not detected at the reported quantitation limit in sediment samples.

[SQL] = The sample quantitation limit. SQL for metals is mg/Kg and the SQL for organics is µg/Kg. $SQL = (CRQL/CRDL) \times (df) / \% \text{ solids}$, where % solids = $[100 - \% \text{ moisture}] / 100$

J, J[^], J_v = The value is an estimated concentration because one or more of the quality control criteria have not been met. It is included to show that the substance has been qualitatively identified as present in this sample. J[^] indicates a high bias and J_v indicates a low bias.

IDL = Instrument detection limit.

L = Reported concentration is between the IDL and CRDL.

CRDL = Contract required detection limit.

M = Reported concentration should be used as a raised quantitation limit because of interferences and/or laboratory contamination.

N = Identification is tentative.

T = Identification is questionable because of absence of other commonly coexisting pesticides.

Shaded samples = The sample met observed release criteria for that hazardous substance.

* = Adjusted result. See Data Usability Table 7.

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
Sample Location/ CLP ID	Hazardous Substance	Concentration	[SQL]	Reference
SE-08 MFHW72 Inorganics	Cadmium	0.50L mg/Kg	[1.5]	Ref. 13, pp. 1-7, 12-15, 23
	Chromium	56.5 mg/Kg	[3.0]	Ref. 13, pp. 1-7, 12-15, 23
	Copper	30.7 mg/Kg	[7.5]	Ref. 13, pp. 1-7, 12-15, 23
	Lead	54.3 mg/Kg	[0.9]	Ref. 13, pp. 1-7, 12-15, 23
	Manganese	107 mg/Kg	[4.5]	Ref. 13, pp. 1-7, 12-15, 23
	Mercury	1.58J* mg/Kg	[0.15]	Ref. 13, pp. 1-7, 12-15, 23
	Nickel	31.7 mg/Kg	[12.0]	Ref. 13, pp. 1-7, 12-15, 23
	Silver	ND	[3.0]	Ref. 13, pp. 1-7, 12-15, 23
	Vanadium	11.5L mg/Kg	[15.0]	Ref. 13, pp. 1-7, 12-15, 23
	Zinc	159 mg/Kg	[6.0]	Ref. 13, pp. 1-7, 12-15, 23
	Cyanide	ND	[1.5]	Ref. 13, pp. 1-7, 12-15, 23
SE-08 FGW52 Volatiles	Carbon Disulfide	NDMJ	[120]	Ref. 15, pp. 1-9, 23-30, 61
	Cyclohexane	ND	[75]	Ref. 15, pp. 1-9, 23-30, 61
	Benzene	48J µg/Kg	[75]	Ref. 15, pp. 1-9, 23-30, 61
	Methylcyclohexane	ND	[75]	Ref. 15, pp. 1-9, 23-30, 61
	Toluene	14J µg/Kg	[75]	Ref. 15, pp. 1-9, 23-30, 61
	Chlorobenzene	780 µg/Kg	[75]	Ref. 15, pp. 1-9, 23-30, 62
	Ethylbenzene	ND	[75]	Ref. 15, pp. 1-9, 23-30, 62
	Xylenes (total)	19J µg/Kg	[75]	Ref. 15, pp. 1-9, 23-30, 62
	Isopropylbenzene	17J µg/Kg	[75]	Ref. 15, pp. 1-9, 23-30, 62
	1,3-Dichlorobenzene	1,100 µg/Kg	[75]	Ref. 15, pp. 1-9, 23-30, 62
	1,4-Dichlorobenzene	460 µg/Kg	[75]	Ref. 15, pp. 1-9, 23-30, 62
Table 6 (Continued)				

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
SE-08 FGW52 Semivolatiles	Hexachlorobutadiene	95,000 µg/Kg	[25,000]	Ref. 15, pp. 1-9, 23-30, 115
	2-Methylnaphthalene	ND	[25,000]	Ref. 15, pp. 1-9, 23-30, 115
	Hexachlorobenzene	38,000 µg/Kg	[25,000]	Ref. 15, pp. 1-9, 23-30, 116
SE-08 FGW52 Pesticides/PCBs	Aldrin	1.12J* µg/Kg	[2.5]	Ref. 15, pp. 1-9, 23-30, 152
	Endosulfan I	ND	[2.5]	Ref. 15, pp. 1-9, 23-30, 152
	Endrin	ND	[4.9]	Ref. 15, pp. 1-9, 23-30, 152
	Aroclor-1248	ND	[49]	Ref. 15, pp. 1-9, 23-30, 152
	Aroclor-1254	37J* µg/Kg	[49]	Ref. 15, pp. 1-9, 23-30, 152
	Aroclor-1260	ND	[49]	Ref. 15, pp. 1-9, 23-30, 152

ND = Not detected. Concentrations for these constituents were not detected at the reported quantitation limit in sediment samples.

[SQL] = The sample quantitation limit. SQL for metals is mg/Kg and the SQL for organics is µg/Kg. $SQL = (CRQL/CRDL) \times (df) / \% \text{ solids}$, where $\% \text{ solids} = [100 - \% \text{ moisture}] / 100$

J, J[^], J_v = The value is an estimated concentration because one or more of the quality control criteria have not been met. It is included to show that the substance has been qualitatively identified as present in this sample. J[^] indicates a high bias and J_v indicates a low bias.

IDL = Instrument detection limit.

L = Reported concentration is between the IDL and CRDL.

CRDL = Contract required detection limit.

M = Reported concentration should be used as a raised quantitation limit because of interferences and/or laboratory contamination.

N = Identification is tentative.

T = Identification is questionable because of absence of other commonly coexisting pesticides.

Shaded samples = The sample met observed release criteria for that hazardous substance.

* = Adjusted result. See Data Usability Table 7.

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
Sample Location/ CLP ID	Hazardous Substance	Concentration	[SQL]	Reference
SE-09 MFHW73 Inorganics	Cadmium	0.37L mg/Kg	[1.5]	Ref. 13, pp. 1-7, 12-15, 24
	Chromium	42.5 mg/Kg	[3.0]	Ref. 13, pp. 1-7, 12-15, 24
	Copper	26.4 mg/Kg	[7.7]	Ref. 13, pp. 1-7, 12-15, 24
	Lead	28.7 mg/Kg	[0.92]	Ref. 13, pp. 1-7, 12-15, 24
	Manganese	89.2 mg/Kg	[4.6]	Ref. 13, pp. 1-7, 12-15, 24
	Mercury	1.75J* mg/Kg	[0.15]	Ref. 13, pp. 1-7, 12-15, 24
	Nickel	25.5 mg/Kg	[12.3]	Ref. 13, pp. 1-7, 12-15, 24
	Silver	ND	[3.0]	Ref. 13, pp. 1-7, 12-15, 24
	Vanadium	8.1L mg/Kg	[15.4]	Ref. 13, pp. 1-7, 12-15, 24
	Zinc	116 mg/Kg	[6.2]	Ref. 13, pp. 1-7, 12-15, 24
	Cyanide	1.5 mg/Kg	[1.5]	Ref. 13, pp. 1-7, 12-15, 24
SE-09 FGW53 Volatiles	Carbon Disulfide	NDMJ	[130]	Ref. 15, pp. 1-9, 23-30, 64
	Cyclohexane	ND	[78]	Ref. 15, pp. 1-9, 23-30, 64
	Benzene	30J µg/Kg	[78]	Ref. 15, pp. 1-9, 23-30, 64
	Methylcyclohexane	ND	[78]	Ref. 15, pp. 1-9, 23-30, 64
	Toluene	11J µg/Kg	[78]	Ref. 15, pp. 1-9, 23-30, 64
	Chlorobenzene	480 µg/Kg	[78]	Ref. 15, pp. 1-9, 23-30, 65
	Ethylbenzene	ND	[78]	Ref. 15, pp. 1-9, 23-30, 65
	Xylenes (total)	12J µg/Kg	[78]	Ref. 15, pp. 1-9, 23-30, 65
	Isopropylbenzene	11J µg/Kg	[78]	Ref. 15, pp. 1-9, 23-30, 65
	1,3-Dichlorobenzene	770 µg/Kg	[78]	Ref. 15, pp. 1-9, 23-30, 65
	1,4-Dichlorobenzene	310 µg/Kg	[78]	Ref. 15, pp. 1-9, 23-30, 65
Table 6 (Continued)				

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
SE-09 FGW53 Semivolatiles	Hexachlorobutadiene	75,000 µg/Kg	[26,000]	Ref. 15, pp. 1-9, 23-30, 118
	2-Methylnaphthalene	ND	[26,000]	Ref. 15, pp. 1-9, 23-30, 118
	Hexachlorobenzene	32,000 µg/Kg	[26,000]	Ref. 15, pp. 1-9, 23-30, 119
SE-09 FGW53 Pesticides/PCBs	Aldrin	1.12J* µg/Kg	[2.7]	Ref. 15, pp. 1-9, 23-30, 153
	Endosulfan I	ND	[2.7]	Ref. 15, pp. 1-9, 23-30, 153
	Endrin	ND	[5.2]	Ref. 15, pp. 1-9, 23-30, 153
	Aroclor-1248	ND	[52]	Ref. 15, pp. 1-9, 23-30, 153
	Aroclor-1254	530 µg/Kg	[52]	Ref. 15, pp. 1-9, 23-30, 153
	Aroclor-1260	ND	[52]	Ref. 15, pp. 1-9, 23-30, 153

ND = Not detected. Concentrations for these constituents were not detected at the reported quantitation limit in sediment samples.

[SQL] = The sample quantitation limit. SQL for metals is mg/Kg and the SQL for organics is µg/Kg. $SQL = (CRQL/CRDL) \times (df) / \% \text{ solids}$, where $\% \text{ solids} = [100 - \% \text{ moisture}] / 100$

J, J[^], J_v = The value is an estimated concentration because one or more of the quality control criteria have not been met. It is included to show that the substance has been qualitatively identified as present in this sample. J[^] indicates a high bias and J_v indicates a low bias.

IDL = Instrument detection limit.

L = Reported concentration is between the IDL and CRDL.

CRDL = Contract required detection limit.

M = Reported concentration should be used as a raised quantitation limit because of interferences and/or laboratory contamination.

N = Identification is tentative.

T = Identification is questionable because of absence of other commonly coexisting pesticides.

Shaded samples = The sample met observed release criteria for that hazardous substance.

* = Adjusted result. See Data Usability Table 7.

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
Sample Location/ CLP ID	Hazardous Substance	Concentration	[SQL]	Reference
SE-14 MFHW78 Inorganics	Cadmium	0.83L mg/Kg	[63.7]	Ref. 12, pp. 1-7, 10-13, 15
	Chromium	56 mg/Kg	[3.4]	Ref. 12, pp. 1-7, 10-13, 15
	Copper	60.2 mg/Kg	[8.4]	Ref. 12, pp. 1-7, 10-13, 15
	Lead	32.6 mg/Kg	[1.01]	Ref. 12, pp. 1-7, 10-13, 15
	Manganese	223 mg/Kg	[5.1]	Ref. 12, pp. 1-7, 10-13, 15
	Mercury	0.45 mg/Kg	[0.17]	Ref. 12, pp. 1-7, 10-13, 15
	Nickel	20.9 mg/Kg	[13.5]	Ref. 12, pp. 1-7, 10-13, 15
	Silver	ND	[3.4]	Ref. 12, pp. 1-7, 10-13, 15
	Vanadium	25.7 mg/Kg	[16.8]	Ref. 12, pp. 1-7, 10-13, 15
	Zinc	174 mg/Kg	[6.7]	Ref. 12, pp. 1-7, 10-13, 15
	Cyanide	0.43LJv mg/Kg	[1.7]	Ref. 12, pp. 1-7, 10-13, 15
SE-14 FGW58 Volatiles	Carbon Disulfide	NDMJ	[32]	Ref. 14, pp. 1-13, 26-34, 38
	Cyclohexane	ND	[16]	Ref. 14, pp. 1-13, 26-34, 38
	Benzene	ND	[16]	Ref. 14, pp. 1-13, 26-34, 38
	Methylcyclohexane	ND	[16]	Ref. 14, pp. 1-13, 26-34, 38
	Toluene	ND	[16]	Ref. 14, pp. 1-13, 26-34, 38
	Chlorobenzene	ND	[16]	Ref. 14, pp. 1-13, 26-34, 39
	Ethylbenzene	ND	[16]	Ref. 14, pp. 1-13, 26-34, 39
	Xylenes (total)	5LJ µg/Kg	[16]	Ref. 14, pp. 1-13, 26-34, 39
	Isopropylbenzene	19 µg/Kg	[16]	Ref. 14, pp. 1-13, 26-34, 39
	1,3-Dichlorobenzene	3LJ µg/Kg	[16]	Ref. 14, pp. 1-13, 26-34, 39
	1,4-Dichlorobenzene	ND	[16]	Ref. 14, pp. 1-13, 26-34, 39
Table 6 (Continued)				

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
Sample Location/ CLP ID	Hazardous Substance	Concentration	[SQL]	Reference
SE-14 FGW58 Semivolatiles	Hexachlorobutadiene	ND	[530]	Ref. 14, pp. 1-13, 26-34, 83
	2-Methylnaphthalene	ND	[530]	Ref. 14, pp. 1-13, 26-34, 83
	Hexachlorobenzene	ND	[530]	Ref. 14, pp. 1-13, 26-34, 84
SE-14 FGW58 Pesticides/PCBs	Aldrin	NDMJ	[6.5]	Ref. 14, pp. 1-13, 26-34, 129
	Endosulfan I	ND	[2.7]	Ref. 14, pp. 1-13, 26-34, 129
	Endrin	1.9LJ µg/Kg	[5.3]	Ref. 14, pp. 1-13, 26-34, 129
	Aroclor-1248	16J* µg/Kg	[53]	Ref. 14, pp. 1-13, 26-34, 129
	Aroclor-1254	ND	[53]	Ref. 14, pp. 1-13, 26-34, 129
	Aroclor-1260	ND	[53]	Ref. 14, pp. 1-13, 26-34, 129

ND = Not detected.

ND = Not detected. Concentrations for these constituents were not detected at the reported quantitation limit in sediment samples.

[SQL] = The sample quantitation limit. SQL for metals is mg/Kg and the SQL for organics is µg/Kg. $SQL = (CRQL/CRDL) \times (df) / \% \text{ solids}$, where $\% \text{ solids} = [100 - \% \text{ moisture}] / 100$

J, J[^], J_v = The value is an estimated concentration because one or more of the quality control criteria have not been met. It is included to show that the substance has been qualitatively identified as present in this sample. J[^] indicates a high bias and J_v indicates a low bias.

IDL = Instrument detection limit.

L = Reported concentration is between the IDL and CRDL.

CRDL = Contract required detection limit.

M = Reported concentration should be used as a raised quantitation limit because of interferences and/or laboratory contamination.

N = Identification is tentative.

T = Identification is questionable because of absence of other commonly coexisting pesticides.

Shaded samples = The sample met observed release criteria for that hazardous substance.

* = Adjusted result. See Data Usability Table 7.

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
Sample Location/ CLP ID	Hazardous Substance	Concentration	[SQL]	Reference
SE-17 MFHW81 Inorganics	Cadmium	1.1 mg/Kg	[1.4]	Ref. 12, pp. 1-7, 10-13, 18
	Chromium	280 mg/Kg	[2.8]	Ref. 12, pp. 1-7, 10-13, 18
	Copper	31.7 mg/Kg	[6.9]	Ref. 12, pp. 1-7, 10-13, 18
	Lead	34.5 mg/Kg	[0.8]	Ref. 12, pp. 1-7, 10-13, 18
	Manganese	3,500 mg/Kg	[4.2]	Ref. 12, pp. 1-7, 10-13, 18
	Mercury	0.17 mg/Kg	[0.14]	Ref. 12, pp. 1-7, 10-13, 18
	Nickel	14.1 mg/Kg	[11.1]	Ref. 12, pp. 1-7, 10-13, 18
	Silver	ND	[2.8]	Ref. 12, pp. 1-7, 10-13, 18
	Vanadium	87.7 mg/Kg	[13.9]	Ref. 12, pp. 1-7, 10-13, 18
	Zinc	225 mg/Kg	[5.6]	Ref. 12, pp. 1-7, 10-13, 18
	Cyanide	0.26LJv mg/Kg	[1.4]	Ref. 12, pp. 1-7, 10-13, 18
SE-17 FGW61 Volatiles	Carbon Disulfide	NDJ	[15]	Ref. 14, pp. 1-13, 26-34, 47
	Cyclohexane	ND	[13]	Ref. 14, pp. 1-13, 26-34, 47
	Benzene	4J µg/Kg	[13]	Ref. 14, pp. 1-13, 26-34, 47
	Methylcyclohexane	ND	[13]	Ref. 14, pp. 1-13, 26-34, 47
	Toluene	4J µg/Kg	[13]	Ref. 14, pp. 1-13, 26-34, 47
	Chlorobenzene	1J µg/Kg	[13]	Ref. 14, pp. 1-13, 26-34, 48
	Ethylbenzene	ND	[13]	Ref. 14, pp. 1-13, 26-34, 48
	Xylenes (total)	2J µg/Kg	[13]	Ref. 14, pp. 1-13, 26-34, 48
	Isopropylbenzene	6J µg/Kg	[13]	Ref. 14, pp. 1-13, 26-34, 48
	1,3-Dichlorobenzene	ND	[13]	Ref. 14, pp. 1-13, 26-34, 48
	1,4-Dichlorobenzene	ND	[13]	Ref. 14, pp. 1-13, 26-34, 48
Table 6 (Continued)				

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
SE-17 FGW61 Semivolatiles	Hexachlorobutadiene	ND	[860]	Ref. 14, pp. 1-13, 26-34, 95
	2-Methylnaphthalene	ND	[860]	Ref. 14, pp. 1-13, 26-34, 95
	Hexachlorobenzene	ND	[860]	Ref. 14, pp. 1-13, 26-34, 96
SE-17 FGW61 Pesticides/PCBs	Aldrin	ND	[2.2]	Ref. 14, pp. 1-13, 26-34, 132
	Endosulfan I	ND	[2.2]	Ref. 14, pp. 1-13, 26-34, 132
	Endrin	ND	[4.3]	Ref. 14, pp. 1-13, 26-34, 132
	Aroclor-1248	ND	[43]	Ref. 14, pp. 1-13, 26-34, 132
	Aroclor-1254	ND	[43]	Ref. 14, pp. 1-13, 26-34, 132
	Aroclor-1260	ND	[43]	Ref. 14, pp. 1-13, 26-34, 132

ND = Not detected. Concentrations for these constituents were not detected at the reported quantitation limit in sediment samples.

[SQL] = The sample quantitation limit. SQL for metals is mg/Kg and the SQL for organics is µg/Kg. $SQL = (CRQL/CRDL) \times (df) / \% \text{ solids}$, where $\% \text{ solids} = [100 - \% \text{ moisture}] / 100$

J, J[^], J_v = The value is an estimated concentration because one or more of the quality control criteria have not been met. It is included to show that the substance has been qualitatively identified as present in this sample. J[^] indicates a high bias and J_v indicates a low bias.

IDL = Instrument detection limit.

L = Reported concentration is between the IDL and CRDL.

CRDL = Contract required detection limit.

M = Reported concentration should be used as a raised quantitation limit because of interferences and/or laboratory contamination.

N = Identification is tentative.

T = Identification is questionable because of absence of other commonly coexisting pesticides.

Shaded samples = The sample met observed release criteria for that hazardous substance.

* = Adjusted result. See Data Usability Table 7.

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
Sample Location/ CLP ID	Hazardous Substance	Concentration	[SQL]	Reference
SE-18 MFHW82 Inorganics	Cadmium	0.44 mg/Kg	[1.5]	Ref. 12, pp. 1-7, 10-13, 19
	Chromium	96.5 mg/Kg	[2.9]	Ref. 12, pp. 1-7, 10-13, 19
	Copper	23.7 mg/Kg	[7.3]	Ref. 12, pp. 1-7, 10-13, 19
	Lead	33.4 mg/Kg	[0.9]	Ref. 12, pp. 1-7, 10-13, 19
	Manganese	411 mg/Kg	[4.4]	Ref. 12, pp. 1-7, 10-13, 19
	Mercury	0.47 mg/Kg	[0.14]	Ref. 12, pp. 1-7, 10-13, 19
	Nickel	18.3 mg/Kg	[11.7]	Ref. 12, pp. 1-7, 10-13, 19
	Silver	ND	[2.9]	Ref. 12, pp. 1-7, 10-13, 19
	Vanadium	18.6 mg/Kg	[14.7]	Ref. 12, pp. 1-7, 10-13, 19
	Zinc	201mg/Kg	[5.9]	Ref. 12, pp. 1-7, 10-13, 19
	Cyanide	NDJv	[1.5]	Ref. 12, pp. 1-7, 10-13, 19
SE-18 FGW62 Volatiles	Carbon Disulfide	7.4J* µg/Kg	[74]	Ref. 14, pp. 1-13, 26-34, 50
	Cyclohexane	ND	[74]	Ref. 14, pp. 1-13, 26-34, 50
	Benzene	55J µg/Kg	[74]	Ref. 14, pp. 1-13, 26-34, 50
	Methylcyclohexane	80 µg/Kg	[74]	Ref. 14, pp. 1-13, 26-34, 50
	Toluene	ND	[74]	Ref. 14, pp. 1-13, 26-34, 50
	Chlorobenzene	ND	[74]	Ref. 14, pp. 1-13, 26-34, 51
	Ethylbenzene	10J µg/Kg	[74]	Ref. 14, pp. 1-13, 26-34, 51
	Xylenes (total)	44J µg/Kg	[74]	Ref. 14, pp. 1-13, 26-34, 51
	Isopropylbenzene	2,200 µg/Kg	[74]	Ref. 14, pp. 1-13, 26-34, 51
	1,3-Dichlorobenzene	ND	[74]	Ref. 14, pp. 1-13, 26-34, 51
	1,4-Dichlorobenzene	ND	[74]	Ref. 14, pp. 1-13, 26-34, 51
Table 6 (Continued)				

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
SE-18 FGW62 Semivolatiles	Hexachlorobutadiene	ND	[970]	Ref. 14, pp. 1-13, 26-34, 98
	2-Methylnaphthalene	390J µg/Kg	[970]	Ref. 14, pp. 1-13, 26-34, 98
	Hexachlorobenzene	ND	[970]	Ref. 14, pp. 1-13, 26-34, 99
SE-18 FGW62 Pesticides/PCBs	Aldrin	NDMJ	[260]	Ref. 14, pp. 1-13, 26-34, 133
	Endosulfan I	2.7J* µg/Kg	[2.5]	Ref. 14, pp. 1-13, 26-34, 133
	Endrin	48 µg/Kg	[4.9]	Ref. 14, pp. 1-13, 26-34, 133
	Aroclor-1248	330J* µg/Kg	[49]	Ref. 14, pp. 1-13, 26-34, 133
	Aroclor-1254	ND	[49]	Ref. 14, pp. 1-13, 26-34, 133
	Aroclor-1260	29J* µg/Kg	[49]	Ref. 14, pp. 1-13, 26-34, 133

ND = Not detected. Concentrations for these constituents were not detected at the reported quantitation limit in sediment samples.

[SQL] = The sample quantitation limit. SQL for metals is mg/Kg and the SQL for organics is µg/Kg. $SQL = (CRQL/CRDL) \times (df) / \% \text{ solids}$, where $\% \text{ solids} = [100 - \% \text{ moisture}] / 100$

J, J[^], J_v = The value is an estimated concentration because one or more of the quality control criteria have not been met. It is included to show that the substance has been qualitatively identified as present in this sample. J[^] indicates a high bias and J_v indicates a low bias.

IDL = Instrument detection limit.

L = Reported concentration is between the IDL and CRDL.

CRDL = Contract required detection limit.

M = Reported concentration should be used as a raised quantitation limit because of interferences and/or laboratory contamination.

N = Identification is tentative.

T = Identification is questionable because of absence of other commonly coexisting pesticides.

Shaded samples = The sample met observed release criteria for that hazardous substance.

* = Adjusted result. See Data Usability Table 7.

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
Sample Location/ CLP ID	Hazardous Substance	Concentration	[SQL]	Reference
SE-19 MFHW83 Inorganics	Cadmium	0.64 mg/Kg	[1.8]	Ref. 12, pp. 1-7, 10-13, 20
	Chromium	78.5 mg/Kg	[3.6]	Ref. 12, pp. 1-7, 10-13, 20
	Copper	43.7 mg/Kg	[8.9]	Ref. 12, pp. 1-7, 10-13, 20
	Lead	37.3 mg/Kg	[1.1]	Ref. 12, pp. 1-7, 10-13, 20
	Manganese	162 mg/Kg	[5.3]	Ref. 12, pp. 1-7, 10-13, 20
	Mercury	0.59 mg/Kg	[0.18]	Ref. 12, pp. 1-7, 10-13, 20
	Nickel	20.4 mg/Kg	[14.2]	Ref. 12, pp. 1-7, 10-13, 20
	Silver	0.73 mg/Kg	[3.6]	Ref. 12, pp. 1-7, 10-13, 20
	Vanadium	17.3 mg/Kg	[17.8]	Ref. 12, pp. 1-7, 10-13, 20
	Zinc	269 mg/Kg	[7.1]	Ref. 12, pp. 1-7, 10-13, 20
	Cyanide	0.75LJv mg/Kg	[1.8]	Ref. 12, pp. 1-7, 10-13, 20
SE-19 FGW63 Volatiles	Carbon Disulfide	NDJ	[58]	Ref. 14, pp. 1-13, 26-34, 56
	Cyclohexane	4J µg/Kg	[17]	Ref. 14, pp. 1-13, 26-34, 56
	Benzene	7J µg/Kg	[17]	Ref. 14, pp. 1-13, 26-34, 56
	Methylcyclohexane	6J µg/Kg	[17]	Ref. 14, pp. 1-13, 26-34, 56
	Toluene	ND	[17]	Ref. 14, pp. 1-13, 26-34, 56
	Chlorobenzene	ND	[17]	Ref. 14, pp. 1-13, 26-34, 57
	Ethylbenzene	ND	[17]	Ref. 14, pp. 1-13, 26-34, 57
	Xylenes (total)	48 µg/Kg	[17]	Ref. 14, pp. 1-13, 26-34, 57
	Isopropylbenzene	100 µg/Kg	[17]	Ref. 14, pp. 1-13, 26-34, 57
	1,3-Dichlorobenzene	3J µg/Kg	[17]	Ref. 14, pp. 1-13, 26-34, 57
	1,4-Dichlorobenzene	ND	[17]	Ref. 14, pp. 1-13, 26-34, 57
Table 6 (Continued)				

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
SE-19 FGW63 Semivolatiles	Hexachlorobutadiene	ND	[11,000]	Ref. 14, pp. 1-13, 26-34, 101
	2-Methylnaphthalene	28,000 µg/Kg	[11,000]	Ref. 14, pp. 1-13, 26-34, 101
	Hexachlorobenzene	NDJv	[11,000]	Ref. 14, pp. 1-13, 26-34, 102
SE-19 FGW63 Pesticides/PCBs	Aldrin	NDM	[290]	Ref. 14, pp. 1-13, 26-34, 135
	Endosulfan I	0.99J* µg/Kg	[2.9]	Ref. 14, pp. 1-13, 26-34, 135
	Endrin	1.8J* µg/Kg	[5.6]	Ref. 14, pp. 1-13, 26-34, 135
	Aroclor-1248	460J* µg/Kg	[56]	Ref. 14, pp. 1-13, 26-34, 135
	Aroclor-1254	ND	[56]	Ref. 14, pp. 1-13, 26-34, 135
	Aroclor-1260	250 µg/Kg	[56]	Ref. 14, pp. 1-13, 26-34, 135

ND = Not detected. Concentrations for these constituents were not detected at the reported quantitation limit in sediment samples.

[SQL] = The sample quantitation limit. SQL for metals is mg/Kg and the SQL for organics is µg/Kg. $SQL = (CRQL/CRDL) \times (df) / \% \text{ solids}$, where $\% \text{ solids} = [100 - \% \text{ moisture}] / 100$

J, J[^], J_v = The value is an estimated concentration because one or more of the quality control criteria have not been met. It is included to show that the substance has been qualitatively identified as present in this sample. J[^] indicates a high bias and J_v indicates a low bias.

IDL = Instrument detection limit.

L = Reported concentration is between the IDL and CRDL.

CRDL = Contract required detection limit.

M = Reported concentration should be used as a raised quantitation limit because of interferences and/or laboratory contamination.

N = Identification is tentative.

T = Identification is questionable because of absence of other commonly coexisting pesticides.

Shaded samples = The sample met observed release criteria for that hazardous substance.

* = Adjusted result. See Data Usability Table 7.

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
Sample Location/ CLP ID	Hazardous Substance	Concentration	[SQL]	Reference
SE-20 MFHW84 Inorganics	Cadmium	1.7 mg/Kg	[3.5]	Ref. 13, pp. 1-7, 12-15, 29
	Chromium	497 mg/Kg	[6.9]	Ref. 13, pp. 1-7, 12-15, 29
	Copper	122 mg/Kg	[17.2]	Ref. 13, pp. 1-7, 12-15, 29
	Lead	101 mg/Kg	[2.1]	Ref. 13, pp. 1-7, 12-15, 29
	Manganese	155 mg/Kg	[10.3]	Ref. 13, pp. 1-7, 12-15, 29
	Mercury	15.74J* mg/Kg	[0.34]	Ref. 13, pp. 1-7, 12-15, 29
	Nickel	47.4 mg/Kg	[27.6]	Ref. 13, pp. 1-7, 12-15, 29
	Silver	1.7 mg/Kg	[6.9]	Ref. 13, pp. 1-7, 12-15, 29
	Vanadium	23.1 mg/Kg	[34.5]	Ref. 13, pp. 1-7, 12-15, 29
	Zinc	818 mg/Kg	[13.8]	Ref. 13, pp. 1-7, 12-15, 29
	Cyanide	ND	[3.5]	Ref. 13, pp. 1-7, 12-15, 29
SE-20 FGW64 Volatiles	Carbon Disulfide	420 µg/Kg	[38]	Ref. 15, pp. 1-9, 23-30, 79
	Cyclohexane	390J^ µg/Kg	[38]	Ref. 15, pp. 1-9, 23-30, 79
	Benzene	182.7J^* µg/Kg	[38]	Ref. 15, pp. 1-9, 23-30, 79
	Methylcyclohexane	540 µg/Kg	[38]	Ref. 15, pp. 1-9, 23-30, 79
	Toluene	36.8J^* µg/Kg	[38]	Ref. 15, pp. 1-9, 23-30, 79
	Chlorobenzene	49 µg/Kg	[38]	Ref. 15, pp. 1-9, 23-30, 80
	Ethylbenzene	49J^* µg/Kg	[38]	Ref. 15, pp. 1-9, 23-30, 80
	Xylenes (total)	140J^* µg/Kg	[38]	Ref. 15, pp. 1-9, 23-30, 80
	Isopropylbenzene	2,800 µg/Kg	[190]	Ref. 15, pp. 1-9, 23-30, 80
	1,3-Dichlorobenzene	320 µg/Kg	[38]	Ref. 15, pp. 1-9, 23-30, 80
	1,4-Dichlorobenzene	85 µg/Kg	[38]	Ref. 15, pp. 1-9, 23-30, 80
Table 6 (Continued)				

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
SE-20 FGW64 Semivolatiles	Hexachlorobutadiene	430J µg/Kg	[5,100]	Ref. 15, pp. 1-9, 23-30, 133
	2-Methylnaphthalene	880J µg/Kg	[5,100]	Ref. 15, pp. 1-9, 23-30, 133
	Hexachlorobenzene	270J µg/Kg	[5,100]	Ref. 15, pp. 1-9, 23-30, 134
SE-20 FGW64 Pesticides/PCBs	Aldrin	230 µg/Kg	[65]	Ref. 15, pp. 1-9, 23-30, 159
	Endosulfan I	0.78J* µg/Kg	[6.5]	Ref. 15, pp. 1-9, 23-30, 159
	Endrin	72 µg/Kg	[13]	Ref. 15, pp. 1-9, 23-30, 159
	Aroclor-1248	4,300 µg/Kg	[130]	Ref. 15, pp. 1-9, 23-30, 159
	Aroclor-1254	ND	[130]	Ref. 15, pp. 1-9, 23-30, 159
	Aroclor-1260	160J* µg/Kg	[130]	Ref. 15, pp. 1-9, 23-30, 159

ND = Not detected. Concentrations for these constituents were not detected at the reported quantitation limit in sediment samples.

[SQL] = The sample quantitation limit. SQL for metals is mg/Kg and the SQL for organics is µg/Kg. $SQL = (CRQL/CRDL) \times (df) / \% \text{ solids}$, where % solids = $[100 - \% \text{ moisture}] / 100$

J, J[^], J_v = The value is an estimated concentration because one or more of the quality control criteria have not been met. It is included to show that the substance has been qualitatively identified as present in this sample. J[^] indicates a high bias and J_v indicates a low bias.

IDL = Instrument detection limit.

L = Reported concentration is between the IDL and CRDL.

CRDL = Contract required detection limit.

M = Reported concentration should be used as a raised quantitation limit because of interferences and/or laboratory contamination.

N = Identification is tentative.

T = Identification is questionable because of absence of other commonly coexisting pesticides.

Shaded samples = The sample met observed release criteria for that hazardous substance.

* = Adjusted result. See Data Usability Table 7.

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
Sample Location/ CLP ID	Hazardous Substance	Concentration	[SQL]	Reference
SE-21 MFHW85 Inorganics	Cadmium	1.4 mg/Kg	[3.2]	Ref. 13, pp. 1-7, 12-15, 30
	Chromium	394 mg/Kg	[6.4]	Ref. 13, pp. 1-7, 12-15, 30
	Copper	99.3 mg/Kg	[15.9]	Ref. 13, pp. 1-7, 12-15, 30
	Lead	84.9 mg/Kg	[1.9]	Ref. 13, pp. 1-7, 12-15, 30
	Manganese	124 mg/Kg	[9.6]	Ref. 13, pp. 1-7, 12-15, 30
	Mercury	7.65J* mg/Kg	[0.32]	Ref. 13, pp. 1-7, 12-15, 30
	Nickel	41.1 mg/Kg	[25.5]	Ref. 13, pp. 1-7, 12-15, 30
	Silver	1.5 mg/Kg	[6.4]	Ref. 13, pp. 1-7, 12-15, 30
	Vanadium	18.0 mg/Kg	[31.9]	Ref. 13, pp. 1-7, 12-15, 30
	Zinc	673 mg/Kg	[12.7]	Ref. 13, pp. 1-7, 12-15, 30
	Cyanide	ND	[3.5]	Ref. 13, pp. 1-7, 12-15, 30
SE-21 FGW65 Volatiles	Carbon Disulfide	ND	[330]	Ref. 15, pp. 1-9, 23-30, 85
	Cyclohexane	NDJv	[160]	Ref. 15, pp. 1-9, 23-30, 85
	Benzene	90Jv µg/Kg	[160]	Ref. 15, pp. 1-9, 23-30, 85
	Methylcyclohexane	300 µg/Kg	[160]	Ref. 15, pp. 1-9, 23-30, 85
	Toluene	19Jv µg/Kg	[160]	Ref. 15, pp. 1-9, 23-30, 85
	Chlorobenzene	24Jv µg/Kg	[160]	Ref. 15, pp. 1-9, 23-30, 86
	Ethylbenzene	53Jv µg/Kg	[160]	Ref. 15, pp. 1-9, 23-30, 86
	Xylenes (total)	610 Jv µg/Kg	[160]	Ref. 15, pp. 1-9, 23-30, 86
	Isopropylbenzene	1,900 µg/Kg	[160]	Ref. 15, pp. 1-9, 23-30, 86
	1,3-Dichlorobenzene	200 µg/Kg	[160]	Ref. 15, pp. 1-9, 23-30, 86
	1,4-Dichlorobenzene	55J µg/Kg	[160]	Ref. 15, pp. 1-9, 23-30, 86
Table 6 (Continued)				

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
SE-21 FGW65 Semivolatiles	Hexachlorobutadiene	290J µg/Kg	[4,400]	Ref. 15, pp. 1-9, 23-30, 136
	2-Methylnaphthalene	450J µg/Kg	[4,400]	Ref. 15, pp. 1-9, 23-30, 136
	Hexachlorobenzene	300J µg/Kg	[4,400]	Ref. 15, pp. 1-9, 23-30, 137
SE-21 FGW65 Pesticides/PCBs	Aldrin	170 µg/Kg	[57]	Ref. 15, pp. 1-9, 23-30, 161
	Endosulfan I	1.4J* µg/Kg	[5.7]	Ref. 15, pp. 1-9, 23-30, 161
	Endrin	66 µg/Kg	[11]	Ref. 15, pp. 1-9, 23-30, 161
	Aroclor-1248	3,400 µg/Kg	[5.7]	Ref. 15, pp. 1-9, 23-30, 161
	Aroclor-1254	ND	[110]	Ref. 15, pp. 1-9, 23-30, 161
	Aroclor-1260	1,100 µg/Kg	[110]	Ref. 15, pp. 1-9, 23-30, 161

ND = Not detected. Concentrations for these constituents were not detected at the reported quantitation limit in sediment samples.

[SQL] = The sample quantitation limit. SQL for metals is mg/Kg and the SQL for organics is µg/Kg. $SQL = (CRQL/CRDL) \times (df) / \% \text{ solids}$, where $\% \text{ solids} = [100 - \% \text{ moisture}] / 100$

J, J[^], J_v = The value is an estimated concentration because one or more of the quality control criteria have not been met. It is included to show that the substance has been qualitatively identified as present in this sample. J[^] indicates a high bias and J_v indicates a low bias.

IDL = Instrument detection limit.

L = Reported concentration is between the IDL and CRDL.

CRDL = Contract required detection limit.

M = Reported concentration should be used as a raised quantitation limit because of interferences and/or laboratory contamination.

N = Identification is tentative.

T = Identification is questionable because of absence of other commonly coexisting pesticides.

Shaded samples = The sample met observed release criteria for that hazardous substance.

* = Adjusted result. See Data Usability Table 7.

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
Sample Location/ CLP ID	Hazardous Substance	Concentration	[SQL]	Reference
SE-22 MFHW86 Inorganics	Cadmium	0.76 mg/Kg	[2.2]	Ref. 12, pp. 1-7, 10-13, 21
	Chromium	188 mg/Kg	[4.5]	Ref. 12, pp. 1-7, 10-13, 21
	Copper	82.2 mg/Kg	[11.2]	Ref. 12, pp. 1-7, 10-13, 21
	Lead	151mg/Kg	[1.3]	Ref. 12, pp. 1-7, 10-13, 21
	Manganese	276 mg/Kg	[6.7]	Ref. 12, pp. 1-7, 10-13, 21
	Mercury	17.8 mg/Kg	[0.22]	Ref. 12, pp. 1-7, 10-13, 21
	Nickel	51 mg/Kg	[17.9]	Ref. 12, pp. 1-7, 10-13, 21
	Silver	62.8mg/Kg	[4.5]	Ref. 12, pp. 1-7, 10-13, 21
	Vanadium	10.2 mg/Kg	[22.3]	Ref. 12, pp. 1-7, 10-13, 21
	Zinc	337 mg/Kg	[8.9]	Ref. 12, pp. 1-7, 10-13, 21
	Cyanide	1.01LJv mg/Kg	[2.2]	Ref. 12, pp. 1-7, 10-13, 21
SE-22 FGW66 Volatiles	Carbon Disulfide	31.0J* µg/Kg	[110]	Ref. 14, pp. 1-13, 26-34, 59
	Cyclohexane	ND	[110]	Ref. 14, pp. 1-13, 26-34, 59
	Benzene	450 µg/Kg	[110]	Ref. 14, pp. 1-13, 26-34, 59
	Methylcyclohexane	390 µg/Kg	[110]	Ref. 14, pp. 1-13, 26-34, 59
	Toluene	950 µg/Kg	[110]	Ref. 14, pp. 1-13, 26-34, 59
	Chlorobenzene	72J µg/Kg	[110]	Ref. 14, pp. 1-13, 26-34, 60
	Ethylbenzene	360 µg/Kg	[110]	Ref. 14, pp. 1-13, 26-34, 60
	Xylenes (total)	1,400 µg/Kg	[110]	Ref. 14, pp. 1-13, 26-34, 60
	Isopropylbenzene	3,900 µg/Kg	[1,110]	Ref. 14, pp. 1-13, 26-34, 60
	1,3-Dichlorobenzene	1,300 µg/Kg	[110]	Ref. 14, pp. 1-13, 26-34, 60
	1,4-Dichlorobenzene	530 µg/Kg	[110]	Ref. 14, pp. 1-13, 26-34, 60
Table 6 (Continued)				

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
SE-22 FGW66 Semivolatiles	Hexachlorobutadiene	ND	[25,000]	Ref. 14, pp. 1-13, 26-34, 107
	2-Methylnaphthalene	20,000J µg/Kg	[25,000]	Ref. 14, pp. 1-13, 26-34, 107
	Hexachlorobenzene	ND	[25,000]	Ref. 14, pp. 1-13, 26-34, 108
SE-22 FGW66 Pesticides/PCBs	Aldrin	NDM	[390]	Ref. 14, pp. 1-13, 26-34, 137
	Endosulfan I	70JN µg/Kg	[4.2]	Ref. 14, pp. 1-13, 26-34, 137
	Endrin	150 µg/Kg	[8.2]	Ref. 14, pp. 1-13, 26-34, 137
	Aroclor-1248	14,000 µg/Kg	[820]	Ref. 14, pp. 1-13, 26-34, 137
	Aroclor-1254	ND	[820]	Ref. 14, pp. 1-13, 26-34, 137
	Aroclor-1260	340J* µg/Kg	[82]	Ref. 14, pp. 1-13, 26-34, 137

ND = Not detected. Concentrations for these constituents were not detected at the reported quantitation limit in sediment samples.

[SQL] = The sample quantitation limit. SQL for metals is mg/Kg and the SQL for organics is µg/Kg. $SQL = (CRQL/CRDL) \times (df) / \% \text{ solids}$, where % solids = $[100 - \% \text{ moisture}] / 100$

J, J[^], J_v = The value is an estimated concentration because one or more of the quality control criteria have not been met. It is included to show that the substance has been qualitatively identified as present in this sample. J[^] indicates a high bias and J_v indicates a low bias.

IDL = Instrument detection limit.

L = Reported concentration is between the IDL and CRDL.

CRDL = Contract required detection limit.

M = Reported concentration should be used as a raised quantitation limit because of interferences and/or laboratory contamination.

N = Identification is tentative.

T = Identification is questionable because of absence of other commonly coexisting pesticides.

Shaded samples = The sample met observed release criteria for that hazardous substance.

* = Adjusted result. See Data Usability Table 7.

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
Sample Location/ CLP ID	Hazardous Substance	Concentration	[SQL]	Reference
SE-23 MFHW87 Inorganics	Cadmium	1.8 mg/Kg	[1.6]	Ref. 12, pp. 1-7, 10-13, 22
	Chromium	77.5 mg/Kg	[3.3]	Ref. 12, pp. 1-7, 10-13, 22
	Copper	39.2 mg/Kg	[8.2]	Ref. 12, pp. 1-7, 10-13, 22
	Lead	77.7 mg/Kg	[0.98]	Ref. 12, pp. 1-7, 10-13, 22
	Manganese	179 mg/Kg	[4.9]	Ref. 12, pp. 1-7, 10-13, 22
	Mercury	6.5 mg/Kg	[0.16]	Ref. 12, pp. 1-7, 10-13, 22
	Nickel	35 mg/Kg	[13.1]	Ref. 12, pp. 1-7, 10-13, 22
	Silver	ND	[3.3]	Ref. 12, pp. 1-7, 10-13, 22
	Vanadium	24.7 mg/Kg	[16.4]	Ref. 12, pp. 1-7, 10-13, 22
	Zinc	483 mg/Kg	[6.6]	Ref. 12, pp. 1-7, 10-13, 22
	Cyanide	0.71LJv mg/Kg	[1.6]	Ref. 12, pp. 1-7, 10-13, 22
SE-23 FGW67 Volatiles	Carbon Disulfide	NDJ	[54]	Ref. 14, pp. 1-13, 26-34, 65
	Cyclohexane	ND	[18]	Ref. 14, pp. 1-13, 26-34, 65
	Benzene	3J µg/Kg	[18]	Ref. 14, pp. 1-13, 26-34, 65
	Methylcyclohexane	7J µg/Kg	[18]	Ref. 14, pp. 1-13, 26-34, 65
	Toluene	2J µg/Kg	[18]	Ref. 14, pp. 1-13, 26-34, 65
	Chlorobenzene	16J µg/Kg	[18]	Ref. 14, pp. 1-13, 26-34, 66
	Ethylbenzene	4J µg/Kg	[18]	Ref. 14, pp. 1-13, 26-34, 66
	Xylenes (total)	22 µg/Kg	[18]	Ref. 14, pp. 1-13, 26-34, 66
	Isopropylbenzene	26 µg/Kg	[18]	Ref. 14, pp. 1-13, 26-34, 66
	1,3-Dichlorobenzene	29 µg/Kg	[18]	Ref. 14, pp. 1-13, 26-34, 66
	1,4-Dichlorobenzene	5J µg/Kg	[18]	Ref. 14, pp. 1-13, 26-34, 66
Table 6 (Continued)				

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
SE-23 FGW67 Semivolatiles	Hexachlorobutadiene	ND	[18,000]	Ref. 14, pp. 1-13, 26-34, 110
	2-Methylnaphthalene	ND	[18,000]	Ref. 14, pp. 1-13, 26-34, 110
	Hexachlorobenzene	ND	[18,000]	Ref. 14, pp. 1-13, 26-34, 111
SE-23 FGW67 Pesticides/PCBs	Aldrin	NDMJ	[11,000]	Ref. 14, pp. 1-13, 26-34, 139
	Endosulfan I	270J µg/Kg	[310]	Ref. 14, pp. 1-13, 26-34, 139
	Endrin	1,000J µg/Kg	[600]	Ref. 14, pp. 1-13, 26-34, 139
	Aroclor-1248	300,000 µg/Kg	[60,000]	Ref. 14, pp. 1-13, 26-34, 139
	Aroclor-1254	ND	[6,000]	Ref. 14, pp. 1-13, 26-34, 139
	Aroclor-1260	ND	[6,000]	Ref. 14, pp. 1-13, 26-34, 139

ND = Not detected. Concentrations for these constituents were not detected at the reported quantitation limit in sediment samples.

[SQL] = The sample quantitation limit. SQL for metals is mg/Kg and the SQL for organics is µg/Kg. $SQL = (CRQL/CRDL) \times (df) / \% \text{ solids}$, where $\% \text{ solids} = [100 - \% \text{ moisture}] / 100$

J, J[^], J_v = The value is an estimated concentration because one or more of the quality control criteria have not been met. It is included to show that the substance has been qualitatively identified as present in this sample. J[^] indicates a high bias and J_v indicates a low bias.

IDL = Instrument detection limit.

L = Reported concentration is between the IDL and CRDL.

CRDL = Contract required detection limit.

M = Reported concentration should be used as a raised quantitation limit because of interferences and/or laboratory contamination.

N = Identification is tentative.

T = Identification is questionable because of absence of other commonly coexisting pesticides.

Shaded samples = The sample met observed release criteria for that hazardous substance.

* = Adjusted result. See Data Usability Table 7.

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
Sample Location/ CLP ID	Hazardous Substance	Concentration	[SQL]	Reference
SE-24 MFHW88 Inorganics	Cadmium	1.4 mg/Kg	[2.2]	Ref. 12, pp. 1-7, 10-13, 23
	Chromium	229 mg/Kg	[4.4]	Ref. 12, pp. 1-7, 10-13, 23
	Copper	104 mg/Kg	[11.1]	Ref. 12, pp. 1-7, 10-13, 23
	Lead	139 mg/Kg	[1.3]	Ref. 12, pp. 1-7, 10-13, 23
	Manganese	221 mg/Kg	[6.7]	Ref. 12, pp. 1-7, 10-13, 23
	Mercury	37.1 mg/Kg	[0.22]	Ref. 12, pp. 1-7, 10-13, 23
	Nickel	70 mg/Kg	[17.8]	Ref. 12, pp. 1-7, 10-13, 23
	Silver	1.0 mg/Kg	[4.4]	Ref. 12, pp. 1-7, 10-13, 23
	Vanadium	18.0 mg/Kg	[22.2]	Ref. 12, pp. 1-7, 10-13, 23
	Zinc	450mg/Kg	[8.9]	Ref. 12, pp. 1-7, 10-13, 23
	Cyanide	0.40LJv mg/Kg	[2.2]	Ref. 12, pp. 1-7, 10-13, 23
SE-24 FGW68 Volatiles	Carbon Disulfide	ND	[1,100]	Ref. 14, pp.1-13, 26-34, 68
	Cyclohexane	ND	[1,100]	Ref. 14, pp.1-13, 26-34, 68
	Benzene	380J µg/Kg	[1,100]	Ref. 14, pp.1-13, 26-34, 68
	Methylcyclohexane	620J µg/Kg	[1,100]	Ref. 14, pp.1-13, 26-34, 68
	Toluene	660J µg/Kg	[1,100]	Ref. 14, pp.1-13, 26-34, 68
	Chlorobenzene	2,200 µg/Kg	[1,100]	Ref. 14, pp.1-13, 26-34, 69
	Ethylbenzene	650J µg/Kg	[1,100]	Ref. 14, pp.1-13, 26-34, 69
	Xylenes (total)	3,500 µg/Kg	[1,100]	Ref. 14, pp.1-13, 26-34, 69
	Isopropylbenzene	9,600 µg/Kg	[1,100]	Ref. 14, pp.1-13, 26-34, 69
	1,3-Dichlorobenzene	33,000 µg/Kg	[2,100]	Ref. 14, pp.1-13, 26-34, 69
	1,4-Dichlorobenzene	3,700 µg/Kg	[1,100]	Ref. 14, pp.1-13, 26-34, 69
Table 6 (Continued)				

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
SE-24 FGW68 Semivolatiles	Hexachlorobutadiene	7,700J µg/Kg	[21,000]	Ref. 14, pp.1-13, 26-34, 113
	2-Methylnaphthalene	4,000J µg/Kg	[21,000]	Ref. 14, pp.1-13, 26-34, 113
	Hexachlorobenzene	2,200J µg/Kg	[21,000]	Ref. 14, pp.1-13, 26-34, 114
SE-24 FGW68 Pesticides/PCBs	Aldrin	NDMJ	[420]	Ref. 14, pp. 1-13, 26-34, 142
	Endosulfan I	ND	[3.6]	Ref. 14, pp. 1-13, 26-34, 142
	Endrin	ND	[7.0]	Ref. 14, pp. 1-13, 26-34, 142
	Aroclor-1248	19,000 µg/Kg	[700]	Ref. 14, pp. 1-13, 26-34, 142
	Aroclor-1254	ND	[70]	Ref. 14, pp. 1-13, 26-34, 142
	Aroclor-1260	ND	[70]	Ref. 14, pp. 1-13, 26-34, 142

ND = Not detected. Concentrations for these constituents were not detected at the reported quantitation limit in sediment samples.

[SQL] = The sample quantitation limit. SQL for metals is mg/Kg and the SQL for organics is µg/Kg. $SQL = (CRQL/CRDL) \times (df) / \% \text{ solids}$, where % solids = $[100 - \% \text{ moisture}] / 100$

J, J[^], J_v = The value is an estimated concentration because one or more of the quality control criteria have not been met. It is included to show that the substance has been qualitatively identified as present in this sample. J[^] indicates a high bias and J_v indicates a low bias.

IDL = Instrument detection limit.

L = Reported concentration is between the IDL and CRDL.

CRDL = Contract required detection limit.

M = Reported concentration should be used as a raised quantitation limit because of interferences and/or laboratory contamination.

N = Identification is tentative.

T = Identification is questionable because of absence of other commonly coexisting pesticides.

Shaded samples = The sample met observed release criteria for that hazardous substance.

* = Adjusted result. See Data Usability Table 7.

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
Sample Location/ CLP ID	Hazardous Substance	Concentration	[SQL]	Reference
SE-25 MFHW89 Inorganics	Cadmium	1.0 mg/Kg	[1.6]	Ref. 12, pp. 1-7, 10-13, 24
	Chromium	76.5 mg/Kg	[3.3]	Ref. 12, pp. 1-7, 10-13, 24
	Copper	89.3 mg/Kg	[8.2]	Ref. 12, pp. 1-7, 10-13, 24
	Lead	30.2 mg/Kg	[0.98]	Ref. 12, pp. 1-7, 10-13, 24
	Manganese	103 mg/Kg	[4.9]	Ref. 12, pp. 1-7, 10-13, 24
	Mercury	0.59 mg/Kg	[0.16]	Ref. 12, pp. 1-7, 10-13, 24
	Nickel	20.1 mg/Kg	[13.1]	Ref. 12, pp. 1-7, 10-13, 24
	Silver	ND	[3.3]	Ref. 12, pp. 1-7, 10-13, 24
	Vanadium	17.1 mg/Kg	[16.4]	Ref. 12, pp. 1-7, 10-13, 24
	Zinc	227 mg/Kg	[6.6]	Ref. 12, pp. 1-7, 10-13, 24
	Cyanide	0.34LJv mg/Kg	[1.6]	Ref. 12, pp. 1-7, 10-13, 24
SE-25 FGW69 Volatiles	Carbon Disulfide	63BJ µg/Kg	[16]	Ref. 14, pp. 1-13, 26-34, 74
	Cyclohexane	2J µg/Kg	[16]	Ref. 14, pp. 1-13, 26-34, 74
	Benzene	2J µg/Kg	[16]	Ref. 14, pp. 1-13, 26-34, 74
	Methylcyclohexane	3J µg/Kg	[16]	Ref. 14, pp. 1-13, 26-34, 74
	Toluene	ND	[16]	Ref. 14, pp. 1-13, 26-34, 74
	Chlorobenzene	ND	[16]	Ref. 14, pp. 1-13, 26-34, 75
	Ethylbenzene	ND	[16]	Ref. 14, pp. 1-13, 26-34, 75
	Xylenes (total)	46 µg/Kg	[16]	Ref. 14, pp. 1-13, 26-34, 75
	Isopropylbenzene	48 µg/Kg	[16]	Ref. 14, pp. 1-13, 26-34, 75
	1,3-Dichlorobenzene	5J µg/Kg	[16]	Ref. 14, pp. 1-13, 26-34, 75
	1,4-Dichlorobenzene	2J µg/Kg	[16]	Ref. 14, pp. 1-13, 26-34, 75
Table 6 (Continued)				

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
SE-25 FGW69 Semivolatiles	Hexachlorobutadiene	35J µg/Kg	[520]	Ref. 14, pp. 1-13, 26-34, 116
	2-Methylnaphthalene	100J µg/Kg	[520]	Ref. 14, pp. 1-13, 26-34, 116
	Hexachlorobenzene	ND	[520]	Ref. 14, pp. 1-13, 26-34, 117
SE-25 FGW69 Pesticides/PCBs	Aldrin	NDM	[110]	Ref. 14, pp. 1-13, 26-34, 143
	Endosulfan I	0.99J µg/Kg	[2.7]	Ref. 14, pp. 1-13, 26-34, 143
	Endrin	12 µg/Kg	[5.2]	Ref. 14, pp. 1-13, 26-34, 143
	Aroclor-1248	1,400 µg/Kg	[52]	Ref. 14, pp. 1-13, 26-34, 143
	Aroclor-1254	ND	[52]	Ref. 14, pp. 1-13, 26-34, 143
	Aroclor-1260	ND	[52]	Ref. 14, pp. 1-13, 26-34, 143

ND = Not detected. Concentrations for these constituents were not detected at the reported quantitation limit in sediment samples.

[SQL] = The sample quantitation limit. SQL for metals is mg/Kg and the SQL for organics is µg/Kg. $SQL = (CRQL/CRDL) \times (df) / \% \text{ solids}$, where $\% \text{ solids} = [100 - \% \text{ moisture}] / 100$

J, J[^], J_v = The value is an estimated concentration because one or more of the quality control criteria have not been met. It is included to show that the substance has been qualitatively identified as present in this sample. J[^] indicates a high bias and J_v indicates a low bias.

IDL = Instrument detection limit.

L = Reported concentration is between the IDL and CRDL.

CRDL = Contract required detection limit.

M = Reported concentration should be used as a raised quantitation limit because of interferences and/or laboratory contamination.

N = Identification is tentative.

T = Identification is questionable because of absence of other commonly coexisting pesticides.

Shaded samples = The sample met observed release criteria for that hazardous substance.

* = Adjusted result. See Data Usability Table 7.

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
Sample Location/ CLP ID	Hazardous Substance	Concentration	[SQL]	Reference
SE-26 MFHW90 Inorganics	Cadmium	0.89 mg/Kg	[1.7]	Ref. 13, pp. 1-7, 12-15, 31
	Chromium	84.4 mg/Kg	[3.4]	Ref. 13, pp. 1-7, 12-15, 31
	Copper	47.2 mg/Kg	[8.5]	Ref. 13, pp. 1-7, 12-15, 31
	Lead	49.8 mg/Kg	[1.0]	Ref. 13, pp. 1-7, 12-15, 31
	Manganese	111 mg/Kg	[5.1]	Ref. 13, pp. 1-7, 12-15, 31
	Mercury	2.84J* mg/Kg	[0.17]	Ref. 13, pp. 1-7, 12-15, 31
	Nickel	20.5 mg/Kg	[13.6]	Ref. 13, pp. 1-7, 12-15, 31
	Silver	0.41 mg/Kg	[3.4]	Ref. 13, pp. 1-7, 12-15, 31
	Vanadium	11.9 mg/Kg	[17.0]	Ref. 13, pp. 1-7, 12-15, 31
	Zinc	238 mg/Kg	[6.8]	Ref. 13, pp. 1-7, 12-15, 31
	Cyanide	ND	[1.7]	Ref. 13, pp. 1-7, 12-15, 31
SE-26 FGW70 Volatiles	Carbon Disulfide	220B µg/Kg	[88]	Ref. 15, pp. 1-9, 23-30, 88
	Cyclohexane	ND	[88]	Ref. 15, pp. 1-9, 23-30, 88
	Benzene	25J µg/Kg	[88]	Ref. 15, pp. 1-9, 23-30, 88
	Methylcyclohexane	69J µg/Kg	[88]	Ref. 15, pp. 1-9, 23-30, 88
	Toluene	38J µg/Kg	[88]	Ref. 15, pp. 1-9, 23-30, 88
	Chlorobenzene	1,700 µg/Kg	[88]	Ref. 15, pp. 1-9, 23-30, 89
	Ethylbenzene	21J µg/Kg	[88]	Ref. 15, pp. 1-9, 23-30, 89
	Xylenes (total)	91 µg/Kg	[88]	Ref. 15, pp. 1-9, 23-30, 89
	Isopropylbenzene	120 µg/Kg	[88]	Ref. 15, pp. 1-9, 23-30, 89
	1,3-Dichlorobenzene	500 µg/Kg	[88]	Ref. 15, pp. 1-9, 23-30, 89
	1,4-Dichlorobenzene	470 µg/Kg	[88]	Ref. 15, pp. 1-9, 23-30, 89
Table 6 (Continued)				

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
SE-26 FGW70 Semivolatiles	Hexachlorobutadiene	30,000 µg/Kg	[12,000]	Ref. 15, pp. 1-9, 23-30, 139
	2-Methylnaphthalene	ND	[12,000]	Ref. 15, pp. 1-9, 23-30, 139
	Hexachlorobenzene	8,500J µg/Kg	[12,000]	Ref. 15, pp. 1-9, 23-30, 140
SE-26 FGW70 Pesticides/PCBs	Aldrin	ND	[3.0]	Ref. 15, pp. 1-9, 23-30, 163
	Endosulfan I	ND	[3.0]	Ref. 15, pp. 1-9, 23-30, 163
	Endrin	ND	[5.8]	Ref. 15, pp. 1-9, 23-30, 163
	Aroclor-1248	ND	[58]	Ref. 15, pp. 1-9, 23-30, 163
	Aroclor-1254	ND	[58]	Ref. 15, pp. 1-9, 23-30, 163
	Aroclor-1260	ND	[58]	Ref. 15, pp. 1-9, 23-30, 163

ND = Not detected. Concentrations for these constituents were not detected at the reported quantitation limit in sediment samples.

[SQL] = The sample quantitation limit. SQL for metals is mg/Kg and the SQL for organics is µg/Kg. $SQL = (CRQL/CRDL) \times (df) / \% \text{ solids}$, where $\% \text{ solids} = [100 - \% \text{ moisture}] / 100$

J, J[^], J_v = The value is an estimated concentration because one or more of the quality control criteria have not been met. It is included to show that the substance has been qualitatively identified as present in this sample. J[^] indicates a high bias and J_v indicates a low bias.

IDL = Instrument detection limit.

L = Reported concentration is between the IDL and CRDL.

CRDL = Contract required detection limit.

M = Reported concentration should be used as a raised quantitation limit because of interferences and/or laboratory contamination.

N = Identification is tentative.

T = Identification is questionable because of absence of other commonly coexisting pesticides.

Shaded samples = The sample met observed release criteria for that hazardous substance.

* = Adjusted result. See Data Usability Table 7.

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
Sample Location/ CLP ID	Hazardous Substance	Concentration	[SQL]	Reference
SE-27 MFHW91 Inorganics	Cadmium	ND	[1.3]	Ref. 12, pp. 1-7, 10-13, 25
	Chromium	13.3 mg/Kg	[2.7]	Ref. 12, pp. 1-7, 10-13, 25
	Copper	10.7 mg/Kg	[6.7]	Ref. 12, pp. 1-7, 10-13, 25
	Lead	13.6 mg/Kg	[0.80]	Ref. 12, pp. 1-7, 10-13, 25
	Manganese	72.6 mg/Kg	[4.0]	Ref. 12, pp. 1-7, 10-13, 25
	Mercury	0.53 mg/Kg	[0.13]	Ref. 12, pp. 1-7, 10-13, 25
	Nickel	8.8 mg/Kg	[10.7]	Ref. 12, pp. 1-7, 10-13, 25
	Silver	ND	[2.7]	Ref. 12, pp. 1-7, 10-13, 25
	Vanadium	10.1 mg/Kg	[13.3]	Ref. 12, pp. 1-7, 10-13, 25
	Zinc	47.6 mg/Kg	[5.3]	Ref. 12, pp. 1-7, 10-13, 25
	Cyanide	NDJv	[1.3]	Ref. 12, pp. 1-7, 10-13, 25
SE-27 FGW71 Volatiles	Carbon Disulfide	ND	[13]	Ref. 14, pp. 1-13, 26-34, 77
	Cyclohexane	ND	[13]	Ref. 14, pp. 1-13, 26-34, 77
	Benzene	ND	[13]	Ref. 14, pp. 1-13, 26-34, 77
	Methylcyclohexane	ND	[13]	Ref. 14, pp. 1-13, 26-34, 77
	Toluene	ND	[13]	Ref. 14, pp. 1-13, 26-34, 77
	Chlorobenzene	ND	[13]	Ref. 14, pp. 1-13, 26-34, 78
	Ethylbenzene	ND	[13]	Ref. 14, pp. 1-13, 26-34, 78
	Xylenes (total)	ND	[13]	Ref. 14, pp. 1-13, 26-34, 78
	Isopropylbenzene	ND	[13]	Ref. 14, pp. 1-13, 26-34, 78
	1,3-Dichlorobenzene	7J µg/Kg	[13]	Ref. 14, pp. 1-13, 26-34, 78
	1,4-Dichlorobenzene	2J µg/Kg	[13]	Ref. 14, pp. 1-13, 26-34, 78
Table 6 (Continued)				

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
SE-27 FGW71 Semivolatiles	Hexachlorobutadiene	1,300 µg/Kg	[430]	Ref. 14, pp. 1-13, 26-34, 122
	2-Methylnaphthalene	ND	[430]	Ref. 14, pp. 1-13, 26-34, 122
	Hexachlorobenzene	2,500J µg/Kg	[430]	Ref. 14, pp. 1-13, 26-34, 123
SE-27 FGW71 Pesticides/PCBs	Aldrin	NDMJ	[17]	Ref. 14, pp. 1-13, 26-34, 145
	Endosulfan I	ND	[2.2]	Ref. 14, pp. 1-13, 26-34, 145
	Endrin	ND	[4.3]	Ref. 14, pp. 1-13, 26-34, 145
	Aroclor-1248	57J* µg/Kg	[43]	Ref. 14, pp. 1-13, 26-34, 145
	Aroclor-1254	ND	[43]	Ref. 14, pp. 1-13, 26-34, 145
	Aroclor-1260	ND	[43]	Ref. 14, pp. 1-13, 26-34, 145

ND = Not detected. Concentrations for these constituents were not detected at the reported quantitation limit in sediment samples.

[SQL] = The sample quantitation limit. SQL for metals is mg/Kg and the SQL for organics is µg/Kg. $SQL = (CRQL/CRDL) \times (df) / \% \text{ solids}$, where $\% \text{ solids} = [100 - \% \text{ moisture}] / 100$

J, J[^], J_v = The value is an estimated concentration because one or more of the quality control criteria have not been met. It is included to show that the substance has been qualitatively identified as present in this sample. J[^] indicates a high bias and J_v indicates a low bias.

IDL = Instrument detection limit.

L = Reported concentration is between the IDL and CRDL.

CRDL = Contract required detection limit.

M = Reported concentration should be used as a raised quantitation limit because of interferences and/or laboratory contamination.

N = Identification is tentative.

T = Identification is questionable because of absence of other commonly coexisting pesticides.

Shaded samples = The sample met observed release criteria for that hazardous substance.

* = Adjusted result. See Data Usability Table 7.

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
Sample Location/ CLP ID	Hazardous Substance	Concentration	[SQL]	Reference
SE-28 MFHW71 Inorganics	Cadmium	ND	[1.3]	Ref. 12, pp. 1-7, 10-13, 14
	Chromium	9.8 mg/Kg	[2.6]	Ref. 12, pp. 1-7, 10-13, 14
	Copper	10.1 mg/Kg	[6.5]	Ref. 12, pp. 1-7, 10-13, 14
	Lead	13.5 mg/Kg	[0.78]	Ref. 12, pp. 1-7, 10-13, 14
	Manganese	74.5 mg/Kg	[3.9]	Ref. 12, pp. 1-7, 10-13, 14
	Mercury	0.8 mg/Kg	[0.13]	Ref. 12, pp. 1-7, 10-13, 14
	Nickel	7.4 mg/Kg	[10.4]	Ref. 12, pp. 1-7, 10-13, 14
	Silver	ND	[2.6]	Ref. 12, pp. 1-7, 10-13, 14
	Vanadium	10.6 mg/Kg	[13.0]	Ref. 12, pp. 1-7, 10-13, 14
	Zinc	48.5 mg/Kg	[5.2]	Ref. 12, pp. 1-7, 10-13, 14
	Cyanide	NDJv	[1.3]	Ref. 12, pp. 1-7, 10-13, 14
SE-28 FGA73 Volatiles	Carbon Disulfide	8J µg/Kg	[13]	Ref. 14, pp. 1-13, 26-34, 35
	Cyclohexane	ND	[13]	Ref. 14, pp. 1-13, 26-34, 35
	Benzene	ND	[13]	Ref. 14, pp. 1-13, 26-34, 35
	Methylcyclohexane	ND	[13]	Ref. 14, pp. 1-13, 26-34, 35
	Toluene	ND	[13]	Ref. 14, pp. 1-13, 26-34, 35
	Chlorobenzene	ND	[13]	Ref. 14, pp. 1-13, 26-34, 36
	Ethylbenzene	ND	[13]	Ref. 14, pp. 1-13, 26-34, 36
	Xylenes (total)	ND	[13]	Ref. 14, pp. 1-13, 26-34, 36
	Isopropylbenzene	ND	[13]	Ref. 14, pp. 1-13, 26-34, 36
	1,3-Dichlorobenzene	2J µg/Kg	[13]	Ref. 14, pp. 1-13, 26-34, 36
	1,4-Dichlorobenzene	ND	[13]	Ref. 14, pp. 1-13, 26-34, 36
Table 6 (Continued)				

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 6 (Continued)

Surface Water Pathway Contaminated Sediment Samples Collected from the Houston Ship Channel, East Fork Tributary and Patrick Bayou				
SE-28 FGA73 Semivolatiles	Hexachlorobutadiene	1,400 µg/Kg	[430]	Ref. 14, pp. 1-13, 26-34, 80
	2-Methylnaphthalene	ND	[430]	Ref. 14, pp. 1-13, 26-34, 80
	Hexachlorobenzene	3,100J µg/Kg	[430]	Ref. 14, pp. 1-13, 26-34, 80
SE-28 FGA73 Pesticides/PCBs	Aldrin	NDMJ	[9.6]	Ref. 14, pp. 1-13, 26-34, 128
	Endosulfan I	ND	[2.2]	Ref. 14, pp. 1-13, 26-34, 128
	Endrin	ND	[4.3]	Ref. 14, pp. 1-13, 26-34, 128
	Aroclor-1248	29J* µg/Kg	[43]	Ref. 14, pp. 1-13, 26-34, 128
	Aroclor-1254	ND	[43]	Ref. 14, pp. 1-13, 26-34, 128
	Aroclor-1260	ND	[43]	Ref. 14, pp. 1-13, 26-34, 128

ND = Not detected. Concentrations for these constituents were not detected at the reported quantitation limit in sediment samples.

[SQL] = The sample quantitation limit. SQL for metals is mg/Kg and the SQL for organics is µg/Kg. $SQL = (CRQL/CRDL) \times (df) / \% \text{ solids}$, where $\% \text{ solids} = [100 - \% \text{ moisture}] / 100$

J, J[^], J_v = The value is an estimated concentration because one or more of the quality control criteria have not been met. It is included to show that the substance has been qualitatively identified as present in this sample. J[^] indicates a high bias and J_v indicates a low bias.

IDL = Instrument detection limit.

L = Reported concentration is between the IDL and CRDL.

CRDL = Contract required detection limit.

M = Reported concentration should be used as a raised quantitation limit because of interferences and/or laboratory contamination.

N = Identification is tentative.

T = Identification is questionable because of absence of other commonly coexisting pesticides.

Shaded samples = The sample met observed release criteria for that hazardous substance.

* = Adjusted result. See Data Usability Table 7.

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 7

Surface Water Pathway Data Usability for Sediment Samples						
Sample Location/ CLP ID	Hazardous Substance	Concentration [SQL] mg/Kg or µg/Kg	Bias*	Bias Correction Calculation*	Release Concentration Corrected for Bias	Usable as a Release Value?
INORGANICS (mg/Kg)						
SE-01/ MFHW65 (Bkgd)	Mercury	0.31J [0.12]	UNK	x 1.83	0.56J	YES
SE-03/ MFHW67 (Bkgd)	Sodium	1,730Jv [1,235]	LOW	x 25.43	43,993.9Jv	YES
SE-04/ MFHW68	Mercury	20.7J [0.19]	UNK	÷ 1.83	11.31J	YES
SE-05/ MFHW69	Mercury	12.1J [0.2]	UNK	÷ 1.83	6.61J	YES
SE-06/ MFHW70	Mercury	41.5J [0.22]	UNK	÷ 1.83	22.68J	YES
SE-07/ MFHW71	Mercury	2.6J [0.14]	UNK	÷ 1.83	1.42J	NO
SE-08/ MFHW72	Mercury	2.9J [0.15]	UNK	÷ 1.83	1.58J	NO
SE-09/ MFHW73	Mercury	3.2J [0.15]	UNK	÷ 1.83	1.75J	YES
SE-20/ MFHW84	Mercury	28.8J [0.34]	UNK	÷ 1.83	15.74J	YES
SE-21/ MFHW85	Mercury	14J [0.32]	UNK	÷ 1.83	7.65J	YES
SE-26/ MFHW90	Mercury	5.2J [0.17]	UNK	÷ 1.83	2.84J	YES
ORGANICS (µg/Kg)						
SE-15/ FGW59 (Bkgd)	Phenanthrene	8,500J [450]	UNK	x 10	85,000J	YES
Table 7 continued ...						

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 7 (Continued)

Surface Water Pathway Data Usability for Sediment Samples						
Sample Location/ CLP ID	Hazardous Substance	Concentration [SQL] mg/Kg or µg/Kg	Bias*	Bias Correction Calculation*	Release Concentration Corrected for Bias	Usable as a Release Value?
ORGANICS (µg/Kg)						
SE-15/ FGW59 (Bkgd)	Pyrene	16,000J [450]	UNK	x 11.86	189,760J	YES
SE-18/ FGW62	Carbon Disulfide	74J [74]	UNK	÷ 10	7.4J	NO
SE-22/ FGW66	Carbon Disulfide	310J [110]	UNK	÷ 10	31.0J	NO
SE-20/ FGW64	Cyclohexane	390J^ [38]	HIGH	NA	NA	YES
SE-06/ FGW50	Benzene	290J^ [100]	HIGH	÷ 1.97	147.2J^	YES
SE-20/ FGW64	Benzene	360J^ [38]	HIGH	÷ 1.97	182.7J^	YES
SE-06/ FGW50	Methylcyclohexane	340J^ [100]	HIGH	NA	NA	YES
SE-20/ FGW64	Methylcyclohexane	540J^ [38]	HIGH	NA	NA	YES
SE-06/ FGW50	Toluene	150J^ [100]	HIGH	÷ 1.63	92.0J^	NO
SE-20/ FGW64	Toluene	60J^ [38]	HIGH	÷ 1.63	36.8J^	NO
SE-05/ FGW49	Chlorobenzene	200Jv [110]	LOW	None Required	-----	YES
SE-06/ FGW50	Chlorobenzene	670J^ [100]	HIGH	÷ 2.0	335J^	YES
SE-07/ FGW51	Chlorobenzene	1,100J^ [720]	HIGH	÷ 2.0	550J^	YES
Table 7 continued ...						

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 7 (Continued)

Surface Water Pathway Data Usability for Sediment Samples						
Sample Location/ CLP ID	Hazardous Substance	Concentration [SQL] mg/Kg or µg/Kg	Bias*	Bias Correction Calculation*	Release Concentration Corrected for Bias	Usable as a Release Value?
SE-06/ FGW50	Ethylbenzene	150J [^] [100]	HIGH	÷ 10.0	15J [^]	NO
SE-20/ FGW64	Ethylbenzene	490J [^] [38]	HIGH	÷ 10.0	49J [^]	YES
SE-05/ FGW49	Xylenes	110J _v [110]	LOW	None Required	-----	YES
SE-06/ FGW50	Xylenes	780J [^] [100]	HIGH	÷ 10.0	78J [^]	NO
SE-20/ FGW64	Xylenes	1,400J [^] [38]	HIGH	÷ 10	140J [^]	YES
SE-21/ FGW65	Xylenes	610J _v [38]	LOW	None Required	-----	YES
SE-05/ FGW49	Isopropylbenzene	180J _v [110]	LOW	None Required	-----	YES
SE-06/ FGW50	Isopropylbenzene	680J [^] [100]	HIGH	NA	NA	YES
SE-05/ FGW49	1,4-Dichlorobenzene	360J _v [110]	LOW	None Required	-----	YES
SE-24/ FGW68	Acenaphthylene	21,000J [21,000]	UNK	÷ 10	2,100J	NO
SE-06/ FGW50	delta-BHC	16J [3.5]	UNK	÷ 10	1.6J	NO
SE-04/ FGW48	gamma-BHC (Lindane)	10J [3.4]	UNK	÷ 11.79	0.85J	NO
SE-19/ FGW63	Heptachlor	19J [2.9]	UNK	÷ 7.88	2.4J	NO
SE-23/ FGW67	Heptachlor	1,100J [310]	UNK	÷ 7.88	139.6J	NO
Table 7 continued ...						

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 7 (Continued)

Surface Water Pathway Data Usability for Sediment Samples						
Sample Location/ CLP ID	Hazardous Substance	Concentration [SQL] mg/Kg or µg/Kg	Bias*	Bias Correction Calculation*	Release Concentration Corrected for Bias	Usable as a Release Value?
SE-25/ FGW69	Heptachlor	4.9J [2.7]	UNK	÷ 7.88	0.62J	NO
SE-08/ FGW52	Aldrin	16J [2.5]	UNK	÷ 14.26	1.12J	NO
SE-09/ FGW53	Aldrin	16J [2.7]	UNK	÷ 14.26	1.12J	NO
SE-18/ FGW62	Endosulfan I	27J [2.5]	UNK	÷ 10.0	2.7J	YES
SE-19/ FGW63	Endosulfan I	9.9J [2.9]	UNK	÷ 10.0	0.99J	NO
SE-20/ FGW64	Endosulfan I	7.8J [6.5]	UNK	÷ 10.0	0.78J	NO
SE-21/ FGW65	Endosulfan I	14J [5.7]	UNK	÷ 10.0	1.4J	NO
SE-04/ FGW48	Endrin	130J [66]	UNK	÷ 14.13	9.2J	NO
SE-19/ FGW63	Endrin	25J [5.6]	UNK	÷ 14.13	1.8J	NO
SE-04/ FGW48	Endosulfan II	12J [6.6]	UNK	÷ 10.0	1.2J	NO
SE-04/ FGW48	4,4'-DDD	15J [6.6]	UNK	÷ 10.0	1.5J	NO
SE-05/ FGW49	4,4'-DDD	12J [7.5]	UNK	÷ 10.0	1.2J	NO
SE-24/ FGW68	alpha-Chlordane	5.5J [3.6]	UNK	÷ 10.0	0.55J	NO
SE-06/ FGW50	Aroclor-1248	3,800J [69]	UNK	÷ 10.0	380J	YES
Table 7 continued ...						

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

TABLE 7 (Continued)

Surface Water Pathway Data Usability for Sediment Samples						
Sample Location/ CLP ID	Hazardous Substance	Concentration [SQL] mg/Kg or µg/Kg	Bias*	Bias Correction Calculation*	Release Concentration Corrected for Bias	Usable as a Release Value?
SE-14/ FGW58	Aroclor-1248	160J [53]	UNK	÷ 10.0	16J	NO
SE-18/ FGW62	Aroclor-1248	3,300J [49]	UNK	÷ 10.0	330J	YES
SE-19/ FGW63	Aroclor-1248	4,600J [49]	UNK	÷ 10.0	460J	YES
SE-27/ FGW71	Aroclor-1248	570J [43]	UNK	÷ 10.0	57J	YES
SE-28/ FGW73	Aroclor-1248	290J [43]	UNK	÷ 10.0	29J	NO
SE-07/ FGW51	Aroclor-1254	320J [48]	UNK	÷ 10.0	32J	NO
SE-08/ FGW52	Aroclor-1254	370J [49]	UNK	÷ 10.0	37J	NO
SE-05/ FGW49	Aroclor-1260	1,800J [75]	UNK	÷ 10.0	180J	YES
SE-06/ FGW50	Aroclor-1260	2,100J [69]	UNK	÷ 10.0	210J	YES
SE-18/ FGW62	Aroclor-1260	290J [49]	UNK	÷ 10.0	29J	NO
SE-20/ FGW64	Aroclor-1260	1,600J [130]	UNK	÷ 10.0	160J	YES
SE-22/ FGW66	Aroclor-1260	3,400J [82]	UNK	÷ 10.0	340J	YES

* Ref. 9, pp. 1-18.

NA = Not available. UNK = Unknown

[SQL] = The sample quantitation limit. SQL for metals is mg/Kg and the SQL for organics is µg/Kg. $SQL = (CRQL/CRDL) \times (df) / \% \text{ solids}$, where $\% \text{ solids} = [100 - \% \text{ moisture}] / 100$

J, J[^], J_v = The value is an estimated concentration because one or more of the quality control criteria have not been met. It is included to show that the substance has been qualitatively identified as present in this sample. J[^] indicates a high bias and J_v indicates a low bias.

SWOF-Surface Water Overland/Flood Migration Pathway
SWOF-Observed Release

Hazardous Substances Released

The Source No. 1 samples collected during the SSI sampling event were analyzed for Organic Target Compound List (TCL) and Inorganic Target Analyte List (TAL) constituents following EPA Contract Laboratory Program (CLP) protocol and analytical methodology (see References 12-15, Analytical Data). The analytical results documented organic and inorganic concentrations greater than or equal to the background sample(s) quantitation limit, if not detected in background. Using the chemical analysis method, sample results revealed elevated concentrations of the following constituents qualifying as observed releases to the surface water migratory pathway (Ref. 1, Section 2.3):

Cadmium	Chromium	
Copper	Lead	
Manganese	Mercury	
Nickel	Silver	
Vanadium	Zinc	
Cyanide		
Carbon Disulfide	Cyclohexane	Benzene
Methylcyclohexane	Toluene	Chlorobenzene
Ethylbenzene	Xylenes (Total)	Isopropylbenzene
1,3-Dichlorobenzene	1,4-Dichlorobenzene	Hexachlorobutadiene
2-Methylnaphthalene	Hexachlorobenzene	Aldrin
Endosulfan I	Endrin	Aroclor-1248
Aroclor-1254	Aroclor-1260	

Since **cadmium, chromium, copper, lead, manganese, mercury, nickel, silver, vanadium, zinc, cyanide, carbon disulfide, cyclohexane, benzene, methylcyclohexane, toluene, chlorobenzene, ethylbenzene, xylenes (total), isopropylbenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, hexachlorobutadiene, 2-methylnaphthalene, hexachlorobenzene, aldrin, endosulfan I, endrin, aroclor 1248, aroclor 1254 and aroclor 1260** have previously been documented to be present in the site source, Source No. 1 - Other (Contaminated Sediments) associated with the HSC, East Fork Tributary and Patrick Bayou and are available to a pathway as specified in HRS Rule Section 2.2.3, the detected contaminants as listed above (and shown in Tables 6 and 7) indicate an observed release to the surface water migratory pathway in the watershed being evaluated (Ref. 1, Section 2.3).

Since an observed release has been established for the watershed, an Observed Release Factor Value of 550 is assigned to the watershed (Ref. 1, Section 4.1.2.1.1).

Observed Release Factor Value: 550

Potential Sources of the Sediment Contamination in Patrick Bayou

As previously stated in Section 2.2.1 of this HRS Documentation Record, specific sources for the contaminants of concern could not be sufficiently identified, but most likely occurred from historical accumulation from a multitude of discharge sources surrounding the site. The surrounding area includes several major petrochemical companies and large-scale manufacturing facilities that discharge large quantities of industrial wastewater under permit to Patrick Bayou and the East Fork Tributary (Ref. 4, pp. 3 and 4). A brief summary of these facilities is included below indicating the type of facility and nature/composition of wastes generated. Although these facilities generate wastes similar to those identified within Patrick Bayou and HSC, attribution to any specific facility/ source has not been definitively established:

- An adjacent facility consisting of oil refinery and chemical manufacturing units. The refinery has been operational since 1929 and produces gasoline, fuels, lubricants, waxes and feed stock for the chemical plant. The chemical plant produces a variety of products including chlorinated organics, plastics, resins and solvents. The facility applied for and maintains wastewater and air discharge permits. The facility lists a total of 92 active hazardous, class 1 and class 2 waste streams from manufacturing and on-site waste treatment processes. Wastes include: spent acetonitrile (methyl cyanide) from recovery units, spent catalyst wastes from cracker units, polybutadiene and butadiene heavy ends, phenol distillation still bottoms, spent sulfolane sludge containing benzene, bis-phenol acetone wastes, spent acids and caustics, chrome wastes from cooling towers/filters, lead/inorganic contaminated media from on-site processes, tank bottom solids from production units, PCB oil/wastes from electrical equipment and oil-water emulsions, concentrated organic aqueous skimmings, sludge w/toxic organics and discharged wastewater from the on-site wastewater treatment processes (Ref. 17, pp. 1-5, 10 and 19-41).
- An adjacent facility that manufactures additives for oil, greases and fuels. The plant has been in operation since 1952. The facility lists a total of 39 active hazardous, class 1 and class 2 waste streams from manufacturing and on-site waste management activities which include: spent acid and caustic aqueous solutions, barium and arsenic filter cake, oily clarifier sludges, reactive aqueous sulfide wastes and waste oils from on-site processes/air pollution control devices; mercury contaminated debris and phosphorus pentasulfide from on-site process units and spill cleanups, and residues and light organic (chlorinated polyisobutylene) liquid wastes from by-product processing (Ref. 18, pp. 3-4 and 17-24).
- An adjacent facility that manufactures vinyl chloride monomer (VCM) for the production of polyvinyl chloride (PVC) products. The facility also incinerates wastes piped from an adjacent facility. The plant has conducted independent operations since 1987 and lists 43 active hazardous, class 1 and class 2 waste streams. Wastes include: PCB contaminated liquids/absorbent from on-site transformers/capacitors, cooling tower sludge, heavy end halogenated solvents and waste lubricant oils from distillation/process equipment and organic/oil contaminated soils from spill cleanups (Ref. 19, pp. 1-3 and 6-16).

In addition to the potential sources described above, runoff also may have occurred from properties upgradient from the bayou.

4.1.3 Human Food Chain Threat

As described in the HRS Rule, the human food chain threat for the watershed of concern will be evaluated based on three factor categories: likelihood of release, waste characteristics and targets (Ref. 1, Section 4.1.3).

4.1.3.1 Human Food Chain Threat - Likelihood of Release

Since an observed release has been documented to the surface water pathway, the same Likelihood of Release Factor Category Value of 550 established for the Drinking Water Threat is also assigned for the Human Food Chain Threat - Likelihood of Release Factor Category Value (Ref. 1, Section 4.1.3.1).

4.1.3.2 Human Food Chain Threat - Waste Characteristics

4.1.3.2.1 Toxicity/Persistence/Bioaccumulation

The following Human Food Chain Toxicity, Persistence and Bioaccumulation Potential Factor Values have been assigned to those substances associated with Source No. 1 and qualifying as an observed release, which have a containment factor greater than 0.

TABLE 8

Surface Water Pathway Hazardous Substance Toxicity, Persistence and Bioaccumulation Potential					
Hazardous Substance	Food Chain Toxicity Factor Value ¹	Persistence Factor Value	Food Chain Bioaccumulation Potential Factor ²	Tox/Per/Bio Factor Value	Reference
Cadmium	10,000	1.0	5,000	5.0E+07	Ref. 2, pp. 6, 15, 65
Chromium	10,000	1.0	5.0	5.0E+04	Ref. 2, pp. 6, 15, 97
Copper	---	1.0	50,000	0	Ref. 2, pp. 6, 15, 104
Lead	10,000	1.0	50	5.0E+05	Ref. 2, pp. 6, 15, 237
Manganese	10,000	1.0	0.5	5.0E+03	Ref. 2, pp. 6, 15, 244
Mercury	10,000	0.4	50,000	2.0E+08	Ref. 2, pp. 6, 15, 246
Nickel	10,000	1.0	0.5	5.0E+03	Ref. 2, pp. 6, 15, 268
Silver	120	1.0	50	6.0E+03	Ref. 2, pp. 6, 15, 343
Vanadium	100	1.0	0.5	5.0E+01	Ref. 2, pp. 6, 15, 410
Zinc	10	1.0	500	5.0E+03	Ref. 2, pp. 6, 15, 418
Cyanide	100	0.4	0.5	2.0E+01	Ref. 2, pp. 6, 15, 113
Carbon Disulfide	10	0.4	500	2.0E+03	Ref. 2, pp. 6, 15, 72
Cyclohexane	1	0.4	500	2.0E+02	Ref. 2, pp. 6, 15, 116
Benzene	100	0.4	5,000	2.0E+05	Ref. 2, pp. 6, 15, 37
Table 8 (Continued)					

TABLE 8 (Continued)

Surface Water Pathway Hazardous Substance Toxicity, Persistence and Bioaccumulation Potential					
Hazardous Substance	Food Chain Toxicity Factor Value ¹	Persistence Factor Value	Food Chain Bioaccumulation Potential Factor ²	Tox/Per/Bio Factor Value	Reference
Methylcyclohexane	NA	NA	NA	NA	NA
Toluene	10	0.4	50	2.0E+02	Ref. 2, pp. 6, 15, 378
Chlorobenzene	100	0.0007	50	3.5E-00	Ref. 2, pp. 6, 15, 86
Ethylbenzene	10	0.4	50	2.0E+02	Ref. 2, pp. 6, 15, 184
Xylenes (Total)	10	0.4	50	2.0E+02	Ref. 2, pp. 6, 15, 415
Isopropylbenzene	1,000	0.4	500	2.0E+05	Ref. 2, pp. 6, 15, 111
1,3-dichlorobenzene	---	0.4	50	0	Ref. 2, pp. 6, 15, 134
1,4-dichlorobenzene	10	0.4	50	2.0E+02	Ref. 2, pp. 6, 15, 135
Hexachlorobutadiene	10,000	1.0	50	5.0E+05	Ref. 2, pp. 6, 15, 217
2-Methylnaphthalene	---	0.4	5,000	0	Ref. 2, pp. 6, 15, 260
Hexachlorobenzene	1,000	1.0	5,000	5.0E+06	Ref. 2, pp. 6, 15, 216
Aldrin	10,000	1.0	50,000	5.0E+08	Ref. 2, pp. 6, 15, 14
Endosulfan I	100	1.0	500	5.0E+04	Ref. 2, pp. 6, 15, 176
Endrin	10,000	1.0	5,000	5.0E+07	Ref. 2, pp. 6, 15, 179
Aroclor 1248	10,000	1.0	50,000	5.0E+08	Ref. 2, pp. 6, 15, 293
Aroclor 1254	10,000	1.0	50,000	5.0E+08	Ref. 2, pp. 6, 15, 293
Aroclor 1260	10,000	1.0	50,000	5.0E+08	Ref. 2, pp. 6, 15, 293

Notes: **Bold** = indicates the highest toxicity/persistence/bioaccumulation factor value.

¹ "Very large river" was the predominant surface water body used for factor value determination along the target distance limit where human food chain threat targets were identified.

² The higher value for salt water or fresh water was used for the human food chain bioaccumulation factor value.

Since prior water quality studies conducted within Patrick Bayou and the nearby HSC indicated brackish water within the HSC (salinity 10.3 ppt at Stations 1 and 2), the higher human food chain bioaccumulation potential factor was used as specified in the HRS Guidance Manual to evaluate human food chain targets located in brackish waters subjected to potential contamination (Ref. 4 p. 11, Table 3; Ref. 3, pp. 239-41).

A review of Table 8 reveals the hazardous substances with the highest Human Food Chain Toxicity/ Persistence/Bioaccumulation Factor Value are **Aldrin**, **Aroclor-1248**, **-1254** and **-1260** with a value of 5.0 x 10⁸ (Ref. 1, Section 4.1.3.2.1.4, Table 4-16; Ref. 2, pp. 2, 6, 14 and 293).

Human Food Chain Threat - Observed Release Factor Value: 550

Toxicity/Persistence/Bioaccumulation Factor Value: 5.0 x 10⁸

4.1.3.2.2 Hazardous Waste Quantity**TABLE 9**

Surface Water Pathway Hazardous Waste Quantity		
Source Number	Source Hazardous Waste Quantity Value (HRS Rule, Section 2.4.2.1.5)	Is Source Hazardous Constituent Quantity data complete? (Yes/No)
1	> 0, but unknown	No
Sum of Values:	> 0, but unknown	

As described in the HRS Rule, Section 2.4.2.2, if the hazardous waste constituent quantity is not adequately determined for the source, and any target for a migration pathway is subject to Level I or Level II concentrations, then assign the greater of either value from HRS Rule Table 2.6 or a value of 100, whichever is greater, as the Hazardous Waste Quantity Factor Value for that pathway (Ref 1, pp. 51592 and 51602).

Based on the Source Hazardous Waste Quantity Value shown in Table 9 above and HRS Rule, Section 2.4.2.2 guidelines, a Hazardous Waste Quantity Factor Value of 100 is assigned for the surface water migration pathway (Ref. 1).

[Note: See discussion under Section 4.1.4.3.1 of this report for rationale used to determine a Hazardous Waste Quantity Factor Value when a pathway target is subjected to Level I or Level II concentrations].

Hazardous Waste Quantity Factor Value: 100

4.1.3.2.3 Waste Characteristics Factor Category Value

The Human Food Chain Threat - Waste Characteristics Factor Category Value is based on the Waste Characteristics Product. The Waste Characteristics Product is the product of the Toxicity/Persistence Factor Value, the Hazardous Waste Quantity Factor Value and the Bioaccumulation Potential Factor Value, subject to maximum values (Ref 1 p. 51620), i.e.,

Where for the Patrick Bayou Site:

$$\begin{aligned}\text{Toxicity/Persistence Factor Value} &= 10,000 \times 1.0 = 1.0 \times 10^4 \\ \text{Hazardous Waste Quantity Factor Value} &= 100\end{aligned}$$

And:

$$\begin{aligned}(\text{Toxicity/Persistence}) \times \text{Hazardous Waste Quantity} &= \\ (1.0 \times 10^4) \times 100 &= 1.0 \times 10^6\end{aligned}$$

Where for the Patrick Bayou Site:

$$\begin{aligned}(\text{Toxicity/Persistence}) \times \text{Hazardous Waste Quantity} &= 1.0 \times 10^6 \\ \text{Bioaccumulation Potential Factor Value} &= 50,000\end{aligned}$$

Therefore:

$$\begin{aligned}(\text{Toxicity/Persistence} \times \text{Hazardous Waste Quantity}) \times \text{Bioaccumulation Potential} &= \\ 1.0 \times 10^6 \times 50,000 &= \underline{5.0 \times 10^{10}}\end{aligned}$$

Based on a Waste Characteristics Product of 5.0×10^{10} , a Waste Characteristics Factor Category Value of 320 is assigned from the HRS Rule, Table 2-7 (Ref. 1, Section 2.4.3.1).

Waste Characteristics Factor Category Value: 320

4.1.3.3 Human Food Chain Threat - Targets

No Level I or Level II observed releases were documented in the Houston Ship Channel fishery.

4.1.3.3.1 Food Chain Individual

Since the industries located along the shoreline of Patrick Bayou generally restrict public access for safety reasons requiring escorts while on-site and there are several above-ground industrial pipelines crossing the bayou near the north entrance restricting access by boat, public fishing within Patrick Bayou is not likely to occur (Ref. 10, p. 9). Since consumption of human food chain organisms could not be documented within Patrick Bayou, the potential or actual human food chain threat exposure factor values were not evaluated for the bayou.

Since an observed release to the watershed has been documented (see Section 4.1.2.1.1 of this report), potential exposure to a food chain individual within the target distance limit (TDL) for the watershed can be evaluated. During the 27-30 March, 2000 SSI sampling event, fishermen were observed catching human food chain organisms (blue crabs) in two locations as shown in photos #1, 2 and 4 along the Houston Ship Channel within the surface water pathway 15-mile TDL (Ref. 10, pp. 6 and 12).

As a result, a food chain individual factor value of 20 is assigned based on the observed release of a hazardous substance with a bioaccumulation potential factor value greater than 500 to the watershed and a fishery present within the TDL as specified in the HRS Rule, Section 4.1.3.3 (Ref. 1).

Food Chain Individual Factor Value: 20

4.1.3.3.2. Population

The Population Factor Value was not scored because of its minimal impact on the site score. The population is therefore unknown, but greater 0.

4.1.3.3.3 Calculation of Human Food Chain Threat - Targets Factor Category Value

As described in the HRS Rule, the Human Food Chain (HFC) Threat - Targets Factor Category Value is calculated by summing the Food Chain Individual and Population Factor Values. The resulting value is assigned as the HFC Threat - Targets Factor Category Value (Ref. 1), i.e.,

Where for the Patrick Bayou Site:

Food Chain Individual Factor Value = 20

Population Factor Value = 0

Therefore:

Food Chain Individual Factor Value + Population Factor Value =
Target Factor Category Value = $20 + 0 = 20$

4.1.3.4 Calculation of Human Food Chain Threat Score

As described in the HRS Rule, the Human Food Chain (HFC) Threat Score is calculated by multiplying the HFC Threat Factor Category Values for Likelihood of Release, Waste Characteristics and Targets. The product of these values is then rounded to the nearest integer and divide by 82,500. The resulting value, subject a maximum of 100, is assigned as the Human Food Chain Threat Score for the watershed (Ref.1, p. 51621), i.e.,

Where for the Patrick Bayou Site:

Food Chain Threat Likelihood of Release Factor Category Value = 550

Food Chain Waste Characteristics Factor Category Value = 320

Food Chain Target Factor Category Value = 20

Therefore:

Human Food Chain Threat Score = $\frac{(550) \times (320) \times (20)}{82,500} = 42.67$

Targets Factor Category Value: 20

Human Food Chain Threat Score: 42.67

4.1.4 Environmental Threat

As described in the HRS Rule, the environmental threat will be evaluated based on three factor categories: likelihood of release, waste characteristics and targets (Ref. 1).

4.1.4.1 Environmental Threat - Likelihood of Release

Since an observed release has been documented to the surface water pathway, the same Likelihood of Release Factor Category Value of 550 established for the Drinking Water Threat is also assigned for the Environmental Threat - Likelihood of Release Factor Category Value (Ref. 1).

4.1.4.2 Environmental Threat - Waste Characteristics

4.1.4.2.1 Ecosystem Toxicity/Persistence/Bioaccumulation

TABLE 10

Surface Water Pathway Hazardous Substance Toxicity, Persistence and Bioaccumulation Potential					
Hazardous Substance	Ecosystem Toxicity Factor Value ¹	Persistence Factor Value	Ecosystem Bioaccumulation Potential Factor ²	Ecosystem Tox/Per/Bio Factor Value	Reference
Cadmium	1,000	1.0	5,000	5.0E+06	Ref. 2, pp. 6, 15, 65
Chromium	100	1.0	5.0	5.0E+02	Ref. 2, pp. 6, 15, 97
Copper	---	1.0	50,000	0	Ref. 2, pp. 6, 15, 104
Lead	1,000	1.0	5,000	5.0E+06	Ref. 2, pp. 6, 15, 237
Manganese	---	1.0	50,000	0	Ref. 2, pp. 6, 15, 244
Mercury	10,000	0.4	50,000	2.0E+08	Ref. 2, pp. 6, 15, 246
Nickel	10	1.0	500	5.0E+03	Ref. 2, pp. 6, 15, 268
Silver	10,000	1.0	50	5.0E+05	Ref. 2, pp. 6, 15, 343
Vanadium	---	1.0	0.5	0	Ref. 2, pp. 6, 15, 410
Zinc	10	1.0	500	5.0E+03	Ref. 2, pp. 6, 15, 418
Cyanide	1,000	0.4	0.5	2.0E+02	Ref. 2, pp. 6, 15, 113
Carbon Disulfide	100	0.4	500	2.0E+04	Ref. 2, pp. 6, 15, 72
Cyclohexane	100	0.4	500	2.0E+04	Ref. 2, pp. 6, 15, 116
Benzene	100	0.4	500	2.0E+04	Ref. 2, pp. 6, 15, 37
Methylcyclohexane	NA	NA	NA	NA	NA
Toluene	100	0.4	50	2.0E+03	Ref. 2, pp. 6, 15, 378
Chlorobenzene	1,000	0.0007	50	3.5E+01	Ref. 2, pp. 6, 15, 86
Ethylbenzene	100	0.4	50	2.0E+03	Ref. 2, pp. 6, 15, 184
Xylenes (Total)	10	0.4	50	2.0E+02	Ref. 2, pp. 6, 15, 415
Isopropylbenzene	100	0.4	500	2.0E+04	Ref. 2, pp. 6, 15, 111
1,3-dichlorobenzene	100	0.4	50	2.0E+03	Ref. 2, pp. 6, 15, 134
Table 10 Continued					

TABLE 10 (Continued)

Surface Water Pathway Hazardous Substance Toxicity, Persistence and Bioaccumulation Potential					
Hazardous Substance	Ecosystem Toxicity Factor Value ¹	Persistence Factor Value	Ecosystem Bioaccumulation Potential Factor ²	Ecosystem Tox/Per/Bio Factor Value	Reference
1,4-dichlorobenzene	100	0.4	50	2.0E+03	Ref. 2, pp. 6, 15, 135
Hexachlorobutadiene	10,000	1.0	5,000	5.0E+07	Ref. 2, pp. 6, 15, 217
2-Methylnaphthalene	1,000	0.4	5,000	2.0E+06	Ref. 2, pp. 6, 15, 260
Hexachlorobenzene	10	1.0	50,000	5.0E+05	Ref. 2, pp. 6, 15, 216
Aldrin	10,000	1.0	50,000	5.0E+08	Ref. 2, pp. 6, 15, 14
Endosulfan I	10,000	1.0	50,000	5.0E+08	Ref. 2, pp. 6, 15, 176
Endrin	10,000	1.0	50,000	5.0E+08	Ref. 2, pp. 6, 15, 179
Aroclor 1248	10,000	1.0	50,000	5.0E+08	Ref. 2, pp. 6, 15, 293
Aroclor 1254	10,000	1.0	50,000	5.0E+08	Ref. 2, pp. 6, 15, 293
Aroclor 1260	10,000	1.0	50,000	5.0E+08	Ref. 2, pp. 6, 15, 293

Notes: **Bold** = indicates the highest toxicity/persistence/bioaccumulation factor value.

¹ "Very large river" was the predominant surface water body used for factor value determination along the target distance limit where sensitive environmental targets were identified.

² The lower value for salt water or fresh water was used for the ecosystem factor value determination.

Ecosystem Toxicity Factor Values for the hazardous substances documented as observed releases were derived from the EPA Superfund Chemical Data Matrix (SCDM) 1996 associated with the surface water migratory pathway (Ref. 2). Since prior water quality studies within Patrick Bayou indicated varying salinity ranging from fresh water (salinity 0.0 ppt at Stations 8 and 9) to brackish water (ranging from 1.2 ppt at Station 10 to 12.4 ppt at Station 4), the lower ecosystem bioaccumulation potential factor value was used as specified in the HRS Guidance Manual to evaluate targets located in brackish waters subject to actual contamination (Ref. 4, p. 11, Table 3; Ref. 3, p. 239-41).

Ecosystem Persistence Factor Values were also derived using SCDM values associated with the surface water migratory pathway using persistence values for a river as the predominant water category (Ref. 2). As specified in the HRS Rule, Section 4.1.4.2.1.2, for contaminated sediments with no identified source, the furthest upstream location with an observed release is to be used at the point of measurement to determine predominant water category (Ref. 1). Since the majority of sensitive environments being evaluated are located within the upper portions of Patrick Bayou, the predominant body of water is more like a river than a tidal basin as shown in Photos #33, 35, 37 and 42 (Ref. 4, p. 11; Ref. 10 pp. 26, 31, 35 and 37).

A review of Table 10 reveals the hazardous substances with the highest Ecosystem Toxicity/Persistence/Bioaccumulation Factor Value are **Aldrin**, **Endosulfan I**, **Endrin** and **Aroclor-1248**, **-1254** and **-1260** with a value of 5.0×10^8 (Ref. 1, Section 4.1.4.2.1.4, Table 4-20; Ref. 2, pp. 2, 6, 14, 179 and 293).

Ecosystem Toxicity/Persistence/Bioaccumulation Factor Value: 5×10^8

4.1.4.2.2 Hazardous Waste Quantity**TABLE 11**

Surface Water Pathway Hazardous Waste Quantity		
Source Number	Source Hazardous Waste Quantity Value (HRS Rule, Section 2.4.2.1.5)	Is Source Hazardous Constituent Quantity data complete? (Yes/No)
1	> 0, but unknown	No
Sum of Values:	> 0, but unknown	

As described in the HRS Rule, Section 2.4.2.2, if the hazardous waste constituent quantity is not adequately determined for the source, and any target for a migration pathway is subject to Level I or Level II concentrations, then assign the greater of either value from HRS Rule Table 2.6 or a value of 100, whichever is greater, as the Hazardous Waste Quantity Factor Value for that pathway (Ref 1).

Based on the Source Hazardous Waste Quantity Value shown in Table 11 above and HRS Rule, Section 2.4.2.2 guidelines, a Hazardous Waste Quantity Factor Value of 100 is assigned for the surface water migration pathway (Ref. 1).

[Note: See discussion under Section 4.1.4.3.1 of this report for rationale used to determine a Hazardous Waste Quantity Factor Value when a pathway target is subjected to Level I or Level II concentrations].

Hazardous Waste Quantity Factor Value: 100

4.1.4.2.3 Waste Characteristics Factor Category Value

The Environmental Threat - Waste Characteristics Factor Category Value is based on the Waste Characteristics Product. The Waste Characteristics Product is the product of the Ecosystem Toxicity/Persistence Factor Value, the Hazardous Waste Quantity Factor Value and the Ecosystem Bioaccumulation Potential Factor Value, subject to maximum values (Ref. 1).

Where for the Patrick Bayou Site:

$$\begin{aligned}\text{Ecosystem Toxicity/Persistence Factor Value} &= 10,000 \times 1.0 = 1.0 \times 10^4 \\ \text{Hazardous Waste Quantity Factor Value} &= 100\end{aligned}$$

And:

$$\begin{aligned}(\text{Ecosystem Toxicity/Persistence}) \times \text{Hazardous Waste Quantity} &= \\ (1.0 \times 10^4) \times 100 &= 1.0 \times 10^6\end{aligned}$$

Where for the Patrick Bayou Site:

$$\begin{aligned}(\text{Ecosystem Toxicity/Persistence}) \times \text{Hazardous Waste Quantity} &= 1 \times 10^6 \\ \text{Ecosystem Bioaccumulation Potential Factor Value} &= 50,000\end{aligned}$$

Therefore:

$$\begin{aligned}(\text{Ecosystem Toxicity/Persistence} \times \text{Hazardous Waste Quantity}) \\ \times \text{Ecosystem Bioaccumulation Potential} &= \\ 1.0 \times 10^6 \times 50,000 &= \underline{5.0 \times 10^{10}}\end{aligned}$$

Based on a Waste Characteristics Product of 5.0×10^{10} , an Environmental Threat - Waste Characteristics Factor Category Value of 320 is assigned from the HRS Rule, Table 2-7 (Ref. 1, Section 2.4.3.1).

Environmental Threat - Waste Characteristics Factor Category Value: 320
--

4.1.4.3 Environmental Threat - Targets

4.1.4.3.1 Sensitive Environments

During the SSI reconnaissance, there were several sensitive areas identified as wetlands located near the confluence of the East Fork tributary and along several small islands located in the lower delta portion of Patrick Bayou (Ref. 10, pp. 35, 37 and 39-40). A total of four (4) wetland sediment samples, SE-23 (MFHW87/FGW67), SE-25 (MFHW89/FGW69), SE-27 (MFHW91/FGW71) and its duplicate SE-28 (MFHW71/FGA73) were collected within these locations during the March 27-30, 2000 SSI. Two of these wetland areas within Patrick Bayou will be evaluated in this section.

4.1.4.3.1.1 Level I Concentrations

Since no surface water samples were collected during the SSI, a Level I Concentrations Factor Value cannot be assigned and the Level I Concentrations Factor Value is assigned a value of 0 (Ref. 1).

Level I Concentrations Factor Value: 0

4.1.4.3.1.2 Level II Concentrations

As described in the HRS Rule, Section 4.1.4.3.1.2, if a hazardous substance is present and meets the observed release criteria, but does not meet or exceed relevant ecological-based benchmarks listed in HRS Rule, Table 4-22, it is considered a Level II concentration (Ref. 1). Table 12 below identifies the sediment samples and hazardous substance identified by chemical analysis that qualify as Level II concentrations with detected levels below applicable ambient aquatic life advisory (AALAC) or ambient water quality screening (AWQC) concentrations (Ref. 1):

TABLE 12

Surface Water Pathway Environmental Threat - Targets - Level II Concentrations					
Sample Designation/ Identification No./ Location	Hazardous Substance	Concentration (mg/Kg or µg/Kg) [SQL] - Level I, II	Ambient Aquatic Life Advisory Conc. (µg/L) ¹	In-Water Distance (miles) ²	Reference
SE-23 FGW67 MFHW87 Wetland Sample within Patrick Bayou	Cadmium	1.8 mg/Kg [1.6] - II	1.0E+00	0.70 mi.	Ref. 12, p. 22 Ref. 14, pp. 65-67 and 139
	Chromium	77.5 mg/Kg [3.3] - II	1.10E+01		
	Mercury	6.5 mg/Kg [0.16] - II	1.20E-02		
	Nickel	35 mg/Kg [13.1] - II	1.60E+02		
	Zinc	483 mg/Kg [6.6] - II	1.10E+02		
	Xylenes	22 µg/Kg [110] - II	NA		
	Isopropylbenzene	26 µg/Kg [18] - II	NA		
	1,3-Dichlorobenzene	29 µg/Kg [18] - II	NA		
	Aroclor 1248	300,000 µg/Kg [60,000] - II	1.40E-02		
SE-25 FGW69 MFHW89 Wetland Sample within Patrick Bayou	Chromium	76.5 mg/Kg [3.3] - II	1.10E+01	0.59 mi.	Ref. 12, p. 24 Ref. 14, pp. 68-69 and 143
	Copper	89.3 mg/Kg [8.2] - II	1.20E+01		
	Xylenes	46 µg/Kg [16] - II	NA		
	Isopropylbenzene	48 µg/Kg [16] - II	NA		
	Endrin	12 µg/Kg [5.2] - II	2.30E-03		
	Aroclor 1248	1,400 µg/Kg [52] - II	1.40E-02		
SE-27 FGW71/73 MFHW91/74 Wetland Samples within Patrick Bayou	Aroclor 1248	57J* µg/Kg [43] - II	1.40E-02	1.50 mi.	Ref. 14, p. 145

Notes: mg/Kg = milligrams per kilogram (parts per million). µg/Kg = micrograms per kilogram (parts per billion).
 [SQL] = Sample Quantitation Limit. SQL = (CRQL/CRDL) x (df) / % solids, where % solids = [100 - % moisture] / 100
 NA = Not available.
¹ Acute concentrations (in µg/L) used for fresh water inhabitants.
² As measured from the furthest upstream release sample location (Ref. 3, p. 216, Highlight 8-14).
 * = Adjusted result. See Data Usability Table 7.

Wetlands Frontage:

As specified in the HRS Rule, Section 4.1.4.3.1.2, when measuring the affected length for a wetland area in rivers, use the length of the wetlands contiguous to the in-water segment of the hazardous substance migration path, i.e., wetland frontage of that portion subject to Level II concentrations as the value for length. For an isolated wetland, use the perimeter of that portion of the wetland subject to Level II concentrations as the length (Ref. 1). Distances were measured using an Alvin No. 1112 map wheel from the La Port Texas, 7.5 Minute Series Topographic National Wetlands Inventory (NWI) Map (Ref. 16). A total of five separate US Fish & Wildlife Service (USFWS) wetlands were identified within Patrick Bayou and along the East Fork Tributary; however, only two were evaluated for HRS purposes located within areas of Level II contamination (Ref. 1; Ref.16 and Ref. 3, p. A-20).

The first wetland segment begins at sample location SE-14/MFHW78/FGW58 located just west of the bridge crossing the East Fork Tributary near the confluence area in the upper portion of Patrick Bayou (see Figure 3), continues north along the east bank of Patrick Bayou beyond sample location SE-19/MFHW83/FGW63 and returns along the west bank to the segment origin. The segment includes wetland sediment sample locations SE-23/MFHW87/FGW67 and SE-25/MFHW89/FGW69 (shown in Figure 3 and photos #35-38). Approximately 0.70 miles of HRS qualifying wetlands (PUSLx - palustrine unconsolidated shore subtidal excavated) as shown on the LaPort, Texas National Wetlands Inventory map lie along the hazardous substance migration pathway/Level II segment (Ref. 3, p. 216, p. 338-339, Highlight 8-66, Highlight 8-14, p. A-22, Highlight A-8; Ref. 16, p. 1).

The second wetland segment begins near Station No. 4 below the Oxy-Vinyls, LP Outfall No. 001 location in the north central portion of Patrick Bayou (see Figure 3), continues north along the east bank of the bayou to include sample location SE-22/MFHW86/FGW66 located along the east bank and returns to the segment origin. Approximately 0.31 miles of HRS qualifying wetlands (PEM1Cx-palustrine emergent persistent seasonally flooded excavated) as shown on the LaPort, Texas National Wetlands Inventory map lie along the hazardous substance migration pathway/Level II segment (Ref. 3, p. 216, Highlight 8-14, p. A-22, Highlight A-8; Ref. 16, p. 1).

<u>Wetland Description</u>	<u>Wetland Location</u>	<u>Wetland Frontage</u>	<u>Wetland Concentration</u>	<u>Level of Reference(s)</u>
Confluence Area	N. of East Fork	3,700' (0.70 mi.)	Level II	Ref. 10, pp. 6, 8, 35, 37
N. Central	Along islands, banks	1,650' (0.31 mi.)	Level II	Ref. 10, pp. 6, 8, 39-40

Based on the sample results indicated in Table 12, both wetland areas located in the upper portion of Patrick Bayou and East Fork Tributary confluence area were identified to contain Level II concentrations based on EPA referenced Ambient Aquatic Life Advisory Concentration (AALAC) values. Therefore, using the criteria described in HRS Rule, Section 4.1.4.3.1.2, the Level II Concentrations Factor Value for the surface water drainage pathway is assigned a value of 50 (Ref. 1).

SWOF-Environmental Threat - Potential Contamination

The Environmental Threat - Level II Concentrations Factor Value is based on the sum of the Sensitive Environments Rating Values (HRS Table 4-23) and Wetlands Rating Values (HRS Table 4-24), excluding Level I concentrations (Ref. 1, Section 4.1.4.3.1.1), i.e.,

Where for the Patrick Bayou Site:

Sensitive Environments Rating Value = Not Evaluated

Wetlands Rating Value = 50

Therefore:

$$\begin{aligned} \text{Sensitive Environments Rating Value} + \text{Wetlands Rating Value} &= \\ \text{Level II Concentrations Factor Value} &= 0 + 50 = \underline{50} \end{aligned}$$

4.1.4.3.1.3 Potential Contamination

Since Level II concentrations have been documented above, any value for potential wetland contamination would not significantly affect the site score. Therefore, potential contamination is not evaluated.

Level II Concentrations Factor Value: 50

4.1.4.3.1.3 Potential Contamination

Since Level II concentrations have been documented above, any value for potential wetland contamination would not significantly affect the site score. Therefore, potential contamination is not evaluated.

Potential Contamination Factor Value (Not Evaluated): 0

4.1.4.3.1.4 Calculation of Environmental Threat - Targets Factor Category Value

As described in the HRS Rule, Section 4.1.4.3.1.4, the Environmental Threat - Targets Factor Category Value for the watershed is the sum of the values for the Level I (0), Level II (50) and Potential Contamination (0) Factor Values. The resulting sum value of 50 is assigned as the Environmental Threat - Target Factor Category Value (Ref. 1).

4.1.4.4 Calculation of Environmental Threat Score for a Watershed

As described in the HRS Rule, the Environmental Threat Score is calculated by multiplying the Environmental Threat Factor Category Values for Likelihood of Release, Waste Characteristics and Targets. The product of these values is then rounded to the nearest integer and divide by 82,500. The resulting value, subject a maximum of 60, is assigned as the Environmental Threat Score for the watershed (Ref.1, p. 51626), i.e.,

Where for the Patrick Bayou Site:

Environmental Threat - Likelihood of Release Factor Category Value = 550

Environmental Threat - Waste Characteristics Factor Category Value = 320

Environmental Threat - Target Factor Category Value = 50

Therefore:

$$\text{Environmental Threat Score} = \frac{(550) \times (320) \times (50)}{82,500} = \underline{106.67} \quad \begin{array}{l} \text{(rounded to 60,} \\ \text{maximum value)} \end{array}$$

Environmental Threat-Target Factor Category Value: 50

Environmental Threat Score: 60

4.1.5 Calculation of Overland/Flood Migration Component Score for a Watershed

As described in the HRS Rule, Section 4.1.5, the Overland/Flood Migration Component Score for the watershed is calculated by summing the scores for the Drinking Water Threat (0), Human Food Chain Threat (42.67) and Environmental Threat (60). The resulting score of 102.67, subject to a maximum value of 100, is assigned as the Surface Water Overland/Flood Migration Component Score for the watershed (Ref. 1).

4.1.6 Calculation of Overland/Flood Migration Component Score

As described in the HRS Rule, Section 4.1.6, the highest surface water Overland/Flood Migration Component Score from the watersheds evaluated (only one watershed was evaluated for this documentation record) is selected and assigned as the Surface Water Overland/Flood Migration Component Score for the site, subject to a maximum of 100. The Surface Water Overland/Flood Migration Component Score is assigned a value of 100 (Ref.1).

Surface Water Overland/Flood Migration Component Score: 100

SWOF/Ground Water to Surface Water Migration Component

4.2 GROUND WATER TO SURFACE WATER MIGRATION COMPONENT

The Ground Water to Surface Water Component was not evaluated because the Surface Water Pathway was maximized at 100 in evaluating the overland/flood component of the surface water pathway.

4.3 CALCULATION OF SURFACE WATER MIGRATION PATHWAY SCORE

Only the Overland/Flood Migration Component (100) was scored. This value of 100 is assigned as the Surface Water Migration Pathway Score.

Surface Water Migration Pathway Score: 100

5.0 SOIL EXPOSURE PATHWAY

5.0.1 General Considerations

The Soil Exposure Pathway was not evaluated due to the lack of targets and because the inclusion of this pathway would not significantly affect the site score.

6.0 AIR MIGRATION PATHWAY

6.1.1 Observed Release

The air migration pathway was not evaluated since a release to the air pathway has not been documented and inclusion of this pathway would not significantly affect the site score.